No. 105, ORIGINAL

In The

Supreme Court of the United States

October Term, 1996

STATE OF KANSAS,

Plaintiff,

v.

STATE OF COLORADO,

Defendant,

and

UNITED STATES OF AMERICA,

Defendant-Intervenor.

ARTHUR L. LITTLEWORTH, Special Master

SECOND REPORT

September 1997

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KANSAS v. COLORADO SECOND REPORT

SECTION I

INTRODUCTION

This is my Second Report on the case. In its May 15, 1995 Opinion, the Court overruled all of the exceptions that were filed by both states to my first Report. *Kansas v. Colorado* 514 U.S. 675, 131 L.Ed.2d 759, 115 S.Ct. 1733 (1995). The case has been bifurcated into a liability and a remedies phase, and the initial Report dealt only with questions of liability. Briefly, in that Report, I recommended that the Court find that postcompact well pumping in Colorado had violated Article IV-D of the Arkansas River Compact, and that Colorado was liable on that fundamental issue. With respect to the additional Kansas claims arising from the operation of Trinidad Reservoir and from the Winter Water Storage Program, I found no violation of the compact, and recommended that Colorado and the United States should prevail on those issues. All of these recommendations were affirmed, and the case was remanded for determination of the unresolved issues in a manner not inconsistent with the Court's Opinion.

While the evidence clearly showed that postcompact well pumping in Colorado had seriously depleted Arkansas River flows into Kansas in violation of the compact, it was not possible in my first Report to quantify the amount of the depletions. Experts for both states in the trial of the liability phase relied upon complex hydrologic models from which to estimate depletions, but their results differed widely. In part, this was due to the

different pumping figures that were used in the respective models. The states also disagreed over the method of determining usable flow as required by the compact. It was necessary to settle these issues before a quantitative finding on depletions could be made. In my first Report, therefore, and while not wholly accepting the data from either state, I recommended that certain adjustments be made to the pumping data, and I set forth the methodology to be used for determining usable flow. These recommendations were approved by the Court, and the models then had to be rerun in accordance with my Report.

Following the Court's May 1995 Opinion, therefore, the remaining issues in the case were:

> (a) Quantifying the depletions in Stateline flow for the period 1950-85. During the liability phase, evidence was limited to the period from 1950, when the compact became operational, to 1985 which was the last year before the Kansas complaint was filed.
>
> (b) Quantifying depletions for the period subsequent to 1985.
>
> (c) Bringing Colorado into current compliance with the provisions of the compact.
>
> (d) Considering a remedy for past depletions.

This Second Report addresses the trial progress on each of these issues, and offers the Court and the parties an opportunity to review certain critical decisions before proceeding further on the issue of damages.

SECTION II

RECENT PROCEDURAL HISTORY

Following the Court's May 15, 1995 Opinion, a status conference to discuss future proceedings was held in Denver, Colorado on July 27-28, 1995. As a result of those proceedings I ordered that the trial on the remedies phase be resumed on October 30, 1995 to receive evidence on three subjects: (1) revisions to the Kansas H-I model[1] in accordance with my Report, and as affirmed by the Supreme Court; (2) Stateline depletions to the usable flow of the Arkansas River caused by postcompact pumping in Colorado for the period 1950-85, as determined by the revised H-I model; and (3) the status of efforts by Colorado to comply with the Arkansas River Compact on a current basis. A copy of the Order dated August 11, 1995 is included as Exhibit 1 in the Appendix.

In that Order I also required Kansas by November 17, 1995 to file a statement of its position with respect to damages, together with a brief in support thereof. Colorado was given until January 19, 1996 in which to file its Response, and Kansas until March 6, 1996 to reply. While the briefing schedule was later modified, these briefs have been filed and are discussed in Sections XII-XV of this Report.

Finally, I ordered that another segment of the trial be scheduled for February 19, 1996 to consider evidence on

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[1] At the Denver conference, the states had agreed that the Kansas H-I model would be the methodology used to determine depletions.

three additional subjects: (1) Stateline depletions as determined by the H-I model for the additional period of 1986-94;[2] (2) Kansas' response to the Colorado evidence on its compliance efforts presented during the October 30 segment of the trial; and (3) continued testimony by Colorado on the status of its program to comply with the compact.

In view of the United States' decision not to take an active role in the remedies phase of the case, the Order also relieved the United States as of July 31, 1995 of its obligation to pay 20% of the fees and costs incurred by the Special Master.

Following a conference call on September 19, 1995 I issued a Supplemental Order dated September 28, 1995. This Order dealt with pumping adjustments that were to be made for declining well efficiencies, and the extent to which accretions shown by the model should be used to offset depletions. A copy of this Order is included in the Appendix as Exhibit 2.

On June 13, 1995 the State of Kansas had filed a Motion for Injunction and requested an expedited hearing. Counsel agreed upon a briefing schedule, and the motion was argued as part of the status conference in Denver on July 27-28, 1995. Kansas sought to have the State of Colorado enjoined from pumping more than 15,000 acre-feet per compact year [i.e., the amount of allowable precompact pumping] until Colorado had

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[2] The year 1994 was the latest year in which complete data required by the H-I model were available.

guaranteed appropriate Stateline flows under the compact. That motion was denied by Order filed September 19, 1995, a copy of which is included as Exhibit 3 in the Appendix. Compliance is discussed more fully in Sections IX-XI of this Report.

By Order of December 7, 1995 the trial schedule set forth in the August 11 Order was partially amended to continue the February 19, 1996 segment to March 25, 1996, and to extend the briefing schedule on damages to January 19, 1996 for Kansas' opening brief, to May 7 for the Colorado response, and to July 26 for the Kansas reply. In addition, another segment of the trial was scheduled for June 17, 1996 to consider Kansas' position on the Colorado compliance evidence presented during earlier trial segments, and to receive any other evidence that Kansas might wish to present in regard to compact compliance.

On February 22, 1996 Kansas filed a Motion to continue the March 25, 1996 trial segment to June 17, 1996, thereby combining it with the trial segment already set for that date. Colorado objected to the Motion, and both states filed briefs in support of their respective positions. Further argument was heard by conference call on February 21, 1996, and I denied the Kansas Motion by Order dated February 22, 1996 for the reasons stated therein. A copy of that Order is included in the Appendix as Exhibit 4.

Based upon the agreement of the parties, the June 17 trial segment was later continued to June 24, and on my order was broadened to consider additional proposed changes to the H-I model for the purpose of determining 1986-94 depletions; to receive rebuttal testimony from

Kansas on the 1986-94 quantification of depletions; and to hear continued evidence on the Colorado compliance program. The Kansas response to Colorado's compliance efforts was continued to a trial segment beginning September 30, 1996. These modifications were made by Order filed April 26, 1996.

Due to the unexpected death of Brent E. Spronk, one of Kansas' chief expert witnesses, the states agreed that it would be necessary to postpone the June 24 trial segment. Accordingly, by Order dated July 10, 1996 the matters scheduled for June 24 were continued to the trial segment commencing September 30, 1996. The items heard are specified in the July 10 Order which is included in the Appendix as Exhibit 5.

This Second Report was issued in draft form on June 5, 1997. Written comments were received from the states on July 2, 1997, and oral argument on the draft report was held on July 16, 1997.

In summary, since the Court's Opinion in May of 1995, there have been 26 days of trial and argument, including testimony by 10 witnesses, and the introduction of 141 exhibits. Depletions to usable Stateline flow for the period 1950-85 were determined by Stipulation, in the amount of 328,505 acre-feet. Evidence estimating depletions for the additional period of 1986-94 is now complete, and I have found that they amount to 91,565 acre-feet, as discussed in Section VIII of this Report. Data were not available to consider depletions beyond the end of 1994. However, once the issues concerning the 1986-94 period have been settled, depletions for 1995, and 1996 if necessary, may well be agreed upon.

SECTION III

USE OF THE KANSAS H-I MODEL

In the liability phase of the trial, experts for both states relied upon computer models from which to estimate Stateline depletions. Colorado utilized four integrated models described as its "Water Budget." The Kansas "model" also consisted of a family of models, modules and sub-routines which received input in the form of certain institutional conditions as well as hydrologic data. It became known as the "hydrologic-institutional model," generally shorthanded to the "H-I model." These modeling efforts were structured so differently that a direct comparison of results was not possible. In my Report to the Court on the liability phase, I did not attempt to choose one modeling analysis over the other, but rather directed that certain data input changes be made in both. Principally, these changes related to pumping estimates in Colorado, both before and after the compact was signed, and in the method for determining usable flow. The compact provides that Stateline flows shall not be "materially depleted in *usable* quantity or availability for use . . . . " (Emphasis added) Article IV-D.

During the liability phase, Colorado experts subjected the original version of the Kansas H-I model to severe criticism, including coding errors that dramatically changed the predicted outcome of the model. The subsequent changes made by Kansas as part of its "replacement case" essentially confirmed the validity of the Colorado attack. Indeed, the corrections and revisions made to the original H-I model reduced the predicted

depletions of usable flow by almost one-half.[3] Even so, Colorado experts continued to testify to additional deficiencies in the model structure that were not changed by the Kansas replacement team.

Against this background, an announcement by Colorado's counsel during the July, 1995 Denver status conference came as a major surprise to everyone in the courtroom. Counsel stated that in view of the time, the expense, and the difficulty involved in bringing the Colorado water budget into compliance with my Report:

> "We have basically shelved that model [i.e., Colorado's own water budget] and are working with or starting to work with the HI Model. That's how we propose to proceed." RT Vol. 144 at 52.
>
> " . . . we also believe that making the changes which you directed to the HIM [i.e., the Kansas H-I model] will be relatively easy, relatively inexpensive and quick . . . We have, therefore, agreed that we will go forward based upon the Kansas testimony that the HIM is the best model to be used, and we are willing to use it." RT Vol. 144 at 62.

Kansas was openly wary of this unexpected shift, and initially stated that Kansas itself would go ahead to make the necessary adjustments to the Colorado model, and "would intend to offer the results of the Colorado

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[3] The Kansas claim, based upon the original version of the H-I model, was 917,000 acre-feet. RT Vol. 45 at 124-25. The comparable figure from the revised H-I model was 496,000 acre-feet. Kan. Exh. 651, Comparison 4.

model as well." RT Vol. 144 at 58-59. The next day, however, Kansas reversed its position. RT Vol. 145 at 5. Kansas recognized that if it were to run the Colorado water budget with the changes mandated in my report, it would cause significant delay in quantifying depletions, as well as in reaching Kansas' major objective of bringing Colorado into current compact compliance.

The unspoken paradox in this small drama was that the Colorado water budget seemed likely to show greater Stateline depletions than the Kansas H-I model. During the liability phase of the trial, Colorado's evidence showed estimated depletions of total Stateline flows for the period 1950-85 of 582,696 acre-feet. Colo. Exh. 135*, p. 6.1, Column 16; RT Vol. 134 at 13; RT Vol. 117 at 75, 102. These were depletions to total flow, not to usable flow as required under the compact. They would have been somewhat less when reduced to usable flow, but Colorado did not make that analysis. However, the Colorado depletions were also on the low side because they were based upon substantially less pumping than the amount determined in my Report. Colorado used 95,925 acre-feet as the amount of average annual pumping as compared to Kansas' pumping estimate of 150,394 acre-feet. Kan. Exh. 731; RT Vol. 133 at 53-54.

Thus, while Colorado's estimated depletions of 582,696 acre-feet cannot be directly compared to the Kansas claim of 489,000 acre-feet (which represented depletions of usable flow), Kansas did make an effort to compare the two models using similar data. Kansas ran its own H-I model but used the lower Colorado pumping figures. The result showed depletions of 395,000 acre-feet

as compared to the Colorado water budget estimate of 582,696 acre-feet. Kan. Exh. 642; RT Vol. 127 at 93.

More recently, Colorado's expert witness, Duane Helton, testified to several reasons why the Colorado water budget should not be used to determine future depletions, concluding that it "overestimated the calculations of depletions at the state line." RT Vol. 153 at 19-20, 22. On the other hand, he testified that the H-I model (as then updated by Colorado) was "reasonable for calculating depletions during the extended period." [i.e., 1986-94] RT Vol. 153 at 22.

Both states, therefore, approached the October 30, 1995 trial segment with the intent to rely upon the H-I model to determine depletions for 1950-85, as well as for the extended period of 1986-94.

SECTION IV

STATELINE DEPLETIONS FOR PERIOD OF 1950-85

The required changes to Kansas' H-I Model for the 1950-85 period were made without significant dispute, although certain controversies were settled by my Order of September 28, 1995. Appendix Exhibit 2. Basically these changes involved modifying the precompact pumping allowance from an average of 11,000 acre-feet annually to 15,000 acre-feet; adjusting Kansas' postcompact pumping figure of 5,810,000 acre-feet in accordance with Colorado's evidence on declining pump efficiencies and nonelectric pumping; and employing the Durbin methodology, using Larson's coefficients, to determine usable flow. Jt. Exhs. 174-177. With these revisions, the H-I model calculated depletions to usable Stateline flow caused by postcompact pumping in Colorado for the period 1950-85 in the amount of 328,505 acre-feet. This result allowed predicted depletions to be offset by accretions shown by the model during the same irrigation season. Jt. Exh. 178, 179; RT Vol. 146 at 9, 15-18.

At the outset of the October 30, 1995 trial segment, the States filed a Stipulation as a "compromise between Kansas and Colorado for the complete and final settlement" of the 1950-85 depletions. The amount is 328,505 acre-feet. A copy of the Stipulation is included in the Appendix as Exhibit 6.

SECTION V

UPDATING THE H-I MODEL FOR THE 1986-94 PERIOD

The states also agreed upon much of the additional data input to the H-I Model required for the 1986-94 period. Those data included irrigated acreage, transmountain deliveries, ungaged tributary inflow, phreatophyte consumption, rainfall and evaporation values for John Martin Reservoir. Kan. Exh. 773; RT Vol. 152 at 27-29. The new data showed a reduction in the irrigated acreage in Colorado of approximately 25,000 acres. The 1950-85 acreage figure used in the H-I Model was 313,867; the 1994 model figure was 288,774. Kan. Exhs. 759, 786; RT Vol. 150 at 12. This was due mainly to the "dry-up" of certain lands by the cities of Colorado Springs and Aurora, and the acquisition of those water rights for future municipal use. RT Vol. 149 at 163; RT Vol. 150 at 11-13.

A. Pumping Data.

Initially, the states were unable to agree on the amount of pumping that occurred during the extended period. The Kansas estimate for total pumping from 1986 through 1994 was 1,360,026 acre-feet. Kan. Exhs. 757, 784. For modeling purposes, the precompact pumping allowance would then be deducted. RT Vol. 153 at 12. The annual average for this period came to 151,114 acre-feet. In comparison, Colorado's estimate of total pumping was 1,238,987 acre-feet, with an annual average of 137,665 acre-feet. Kan. Exh. 784.

In compiling its pumping data, Kansas experts followed generally the same approach used in the liability phase, as approved in my Report. Colorado, on the other hand, took advantage of the recent data reported under its new Measurement Rules and assigned individual power records to individual wells. RT Vol. 150 at 29. Kansas acknowledged that the Colorado methodology would produce more accurate estimates if their figures were "all right." RT Vol. 150 at 32. After checking the Colorado data, Kansas agreed to use the Colorado pumping data to determine depletions for 1986-94, but in a written Stipulation Kansas reserved its rights for future determinations. A copy of that Stipulation is included in the Appendix as Exhibit 7.

These pumping data were incorporated by Kansas into its March 1996 version of the H-I model, showing Stateline depletions of usable flow (offset by seasonal accretions) for the period 1986-94 in the total amount of 91,565 acre-feet.[4] Kan. Exh. 787. Colorado, however, did not agree with certain of the changes made by Kansas to the H-I model, and using the earlier version of the model, Colorado calculated depletions for 1986-94 at 30,700 acre-feet. Colo. Exh. 1040.

B. Coding Changes to the H-I Model.

In addition to the new data input for the 1986-94 period, Kansas also made certain coding changes to the

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[4] Using Kansas' initial pumping estimates, depletions were estimated by Kansas to be 98,637 acre-feet. RT Vol. 151 at 88.

model. Kan. Exhs. 756, 773. These included several technical modifications to better replicate the historical operations of John Martin Reservoir, and modifications to the operations of the Rocky Ford and Colorado Canals to reflect transfers of water rights for municipal use. Colorado was in agreement with most of these revisions, but strongly opposed the changes which Kansas made to the model's maximum farm efficiency. This value defines the maximum amount of irrigation water available to the crop, after losses, as a percentage of the water deliveries to the farm. Losses (i.e., water not used by the crop) consist of tailwater runoff, on-farm lateral losses, and deep percolation beyond the root zone of the crop. This maximum efficiency factor becomes critical in the model's calculations of Stateline depletions. As the factor is lowered, depletions increase, and vice-versa. RT Vol. 152 at 14. A good portion of the trial was devoted to this subject, which is discussed in detail in Section VI.

C. Calibration of the Updated Kansas Version of the H-I Model.

Because of the nine years of added data, the changes in the simulation of John Martin Reservoir operations, and the reduction in the maximum effective farm efficiency, Kansas experts believed that it was necessary to recalibrate the model. Kan. Exh. 773; RT Vol. 151 at 74. Predicted model output was compared with observed values over the full period from 1950 to 1994, and Kansas experts testified to the reasonableness of the results. RT Vol. 151 at 108, 145-46. Calibration was achieved by

adjustments to these parameters: SEV values (which calculate nonbeneficial consumptive use of water); monthly Stateline demands with the 1980 Resolution in effect; WANT factors for several canal systems; and restoration of canal capacities for the Fort Lyon, Holbrook and Lamar Canals. Kan. Exh. 773 at 12-13. Kansas experts testified that all of the changes made in the updated Kansas version of the H-I model were needed and improved the model's performance; indeed, that the prior version should no longer be used. RT Vol. 151 at 91, 97-98; RT Vol. 150 at 64; RT Vol. 151 at 135; RT Vol. 152 at 6, 17-18. The calibration results of the updated Kansas version of the H-I model are found in Kansas Exhibits 760 and 761, and discussed by their experts at RT Vol. 151 at 77-83 and RT 151 at 131-140.

Dewayne R. Schroeder, an engineer employed by the Colorado Division of Water Resources, is Colorado's expert on the H-I model. Early in the proceedings, he had been assigned to the sole task of reviewing and understanding the Kansas model, and was one of the first experts to uncover some of the errors and deficiencies in the original version of the H-I model. However, even after the model had been substantially revised by Kansas' replacement experts, Schroeder continued to voice strong reservations about its accuracy. Primarily, his concerns stemmed from certain "restrictive" factors imbedded in the structure of the model, i.e., the diversion reduction factors, the reduced canal capacities, and the low WANT factors. Yet each of these parameters was stoutly defended by the Kansas experts as being a commonly used modeling technique, necessary in this case to match predicted with actual diversions of stream flow.

Nonetheless, given the decision by both states to use the H-I model for the 1986-94 period, Mr. Schroeder took the model version used to stipulate to the 1950-85 depletions, added the nine years of data input agreed upon, and made a limited number of coding changes. Generally the coding changes were the same as the Kansas modifications, but he did not include Kansas' new farm efficiency factors, or Kansas' change to the SEV values, or all of Kansas' changes affecting the operations of John Martin Reservoir. Colo. Exh. 1025; RT Vol. 152 at 36, 38. This version of the H-I model was referred to as the "Colorado updated H-I model." RT Vol. 151 at 136-37; RT Vol. 152 at 38. Colorado also undertook calibration studies, the results of which appear in Colorado Exhibits 1026-36 (including those with an asterisk), and are discussed in RT Vol. 152 at 39-55.

Model calibration, however, does not necessarily assure accuracy of the model results. These two updated and calibrated models produced widely disparate results. For the period 1986-94 the Kansas updated H-I model, using Colorado's pumping figures, calculated depletions of usable Stateline flow in the total amount of 91,565 acre-feet. Kan. Exh. 787. The Colorado updated H-I model calculated 30,700 acre-feet. Colo. Exhs. 1037, 1040; RT Vol. 152 at 57. Calibration is not necessarily "unique." That is, it may be achieved by adjusting different model parameters, and depends in part upon judgment and experience. RT Vol. 151 at 71, 119; RT Vol. 152 at 20.

Mr. Schroeder testified that both models were calibrated to "more or less the same extent." RT Vol. 152 at 44. So far as calibration was concerned, he thought that each model was "just as good as the other." *Id.* at 38. Yet

he testified that both the Colorado and Kansas versions of the updated H-I model were "inappropriate and inaccurate as they presently exist."[5] RT Vol. 152 at 72. This rather unusual conclusion stems from his consistent objections to the use of restrictive factors in the H-I model, and the fact that both versions of the updated model included these parameters. As a result, Mr. Schroeder testified, "I don't know what an accurate depletion [for 1986-94] would be."[6] RT 152 at 110.

D. H-I Model's Ability to Predict Depletions.

The principal cause of the different depletion estimates for 1986-94 does not depend on which model is better calibrated. Rather, the spread comes from the different maximum farm efficiency factors used by the two states, and the consequent change made by Kansas to the SEV values. RT Vol. 152 at 61, 66. The version of the H-I model used by Kansas during the liability phase of the trial had an effective maximum efficiency of 87 percent. That is to say, the model allowed consumptive use by the crops to rise to a maximum of 87 percent of the water delivered to the farm, and thus, under those circumstances, restricted tailwater runoff and deep percolation

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[5] Although he added that the Colorado version was "more appropriate" because it did not include a "selective" change, namely, in the maximum farm efficiency factor. RT Vol. 152 at 72-73, 82-83.

[6] However, Colorado's other expert witness, Duane Helton, testified that the results of the updated Colorado H-I model were "reasonable" for calculating 1986-94 depletions. RT Vol. 153 at 18-19, 21-22.

to 13 percent. Experts for both states at one point or another during the trial testified that a maximum limit of 87 percent was too high, although Colorado witnesses maintained that the factor should not be "selectively" changed. Reducing the efficiency percentage has the effect in the model of increasing Stateline depletions, and Colorado argued that if the maximum farm efficiency factor is lowered, then the restrictive factors in the model that act to increase depletions must also be addressed.

Colorado, in the water budget model which it used earlier, employed a maximum farm efficiency factor of 75 percent. RT Vol. 153 at 27. Kansas in its updated H-I model reduced the effective 87 percent maximum to 65 percent for most canals, with two set at 70 and 75 percent. Colorado, on the other hand, retained the 87 percent in its updated version of the H-I model. RT Vol. 153 at 27. When Mr. Schroeder made a run of the Colorado updated H-I model using a 75 percent maximum farm efficiency, the Stateline depletions to usable flow increased to between 60,000 and 70,000 acre-feet for the 1986-94 period. RT Vol. 152 at 117. This was in contrast to Colorado's estimate of depletions of 30,700 without such change. The maximum farm efficiency, however, is not the only evidence that needs to be considered in the choice of model results.

The Colorado updated H-I model calculates that over one million acre-feet of pumping during 1986-94 causes only 30,700 acre-feet of depletions of usable Stateline flow. On its face, this model result seems questionable, even considering the fact that transmountain imports increased by about 10,000 acre-feet annually over the

1950-85 average, and that the percentage of return flows from such deliveries also increased. RT Vol. 153 at 16-18.

For the 1950-85 period, the original Colorado water budget used in the liability phase calculated the ratio of depletions of Stateline flow to pumping as 16.9 percent. For the same period the updated Kansas H-I model was almost identical, at 16.7 percent. But making the same comparison for the 1986-94 period, the Kansas updated H-I model showed depletions as 14.1 percent of pumping while the Colorado updated H-I model calculated only 6.3 percent. Kan. Exh. 765; RT Vol. 151 at 137-39.

The Colorado updated H-I model retained the use of 87 percent as the maximum farm efficiency. This percentage, as opposed to the 75 percent used in the Colorado water budget, or the 65 to 75 percent range used in the Kansas updated version of the H-I model, was generally acknowledged to reduce Stateline depletions.

Mr. Helton recognized that using the 87 percent factor in the H-I model during the liability phase led to low estimates of deep percolation, which, in turn, "underestimated depletions at the state line." RT Vol. 153 at 19. He thought, however, that other deficiencies in the model overestimated depletions. And he concluded that "on a long-term basis, those deficiencies ought to compensate, and the end result of that ought to be somewhat reasonable." *Id.*

There is also evidence that the Kansas H-I model used for the 1950-85 period produced a low estimate of Stateline depletions. Colorado's new Use Rules that imposed strict regulations on pumping were protested and the subject of a trial in the Colorado District Court,

Water Division 2, at which both Colorado experts, Helton and Schroeder, testified. The Court in its April 30, 1996 decision upholding the new Rules referred to Helton's testimony:

> "Helton believes the Colorado Water Budget Analysis overestimates depletions and that the model in question [i.e., the H-I model before being updated for 1986-94] *underestimates depletions.*" Colo. Exh. 1051, Appendix A at 12, emphasis added.

Kansas expert Book was also of the opinion that the depletions shown by the version of the H-I model used by Kansas during the liability phase of trial were low. RT Vol. 150 at 64.

Moreover, Mr. Schroeder acknowledged on cross-examination that if pumping variations were removed, the Kansas updated H-I model would produce about the same amount of depletions as the original Colorado water budget model used during the liability phase. RT Vol. 152 at 116-17.

There is no way to prove the accuracy of either state's modeling efforts, but there are solid indications that the H-I model as used by Kansas during the liability phase of the trial, and now used by Colorado for 1986-94, may well underestimate depletions. The fact that the Colorado water budget may also have overestimated depletions does not detract from an apparent need to adjust the H-I model, which is now being relied upon by both states to determine depletions for 1986-94. Whether the specific changes incorporated by Kansas into its updated version of the H-I model are proper is a separate issue discussed later in this Report.

SECTION VI

THE MAXIMUM FARM EFFICIENCY FACTOR

The original version of the H-I model effectively limited farm irrigation efficiency to 87 percent for all canal systems. RT Vol. 150 at 48. The effective maximum farm irrigation efficiency was not reviewed or changed when the "replacement experts" made their revisions to the model. RT Vol. 150 at 69-70. The importance of this technical and seemingly obscure modeling parameter lies in the fact that Stateline depletions are "extremely sensitive" to the percentage that is applied. RT Vol. 150 at 74.

Kansas' expert, Dale Book, first became concerned in October of 1995 about unreasonable estimates of irrigation return flows in the Kansas model. RT Vol. 150 at 64-66. At that time the model had already been used as the basis for the Stipulation determining the 1950-85 depletions. The Colorado State Engineer was also then beginning to use the H-I model to check certain presumptive stream depletions that were part of Colorado's new proposed rules to regulate pumping in Colorado. For wells used to supplement a canal supply, the new rules presumed that depletions to the Arkansas River would equal 30 percent of the amount pumped; for wells that were the sole source of irrigation water, the presumed depletions were 50 percent; and for sole source sprinkler systems, the presumed depletions were 75 percent. Colo. Exh. 1018, Rule 4.2. Depletions were required to be made up with replacement water, and relying upon the results of the H-I model using these percentages, the Colorado State Engineer believed that Stateline flows would be fully protected. RT Vol. 150 at 65. Mr. Book, however,

thought that the presumptive depletions should have been higher, and he set about "to try to figure out what was going on." RT Vol. 150 at 65-66.

The Kansas experts concluded that the 87 percent effective maximum farm efficiency in the H-I model was causing it to overestimate the consumption of applied irrigation water, to underestimate return flows to the river from tailwater and deep percolation, and thereby to underestimate depletions at the Stateline. RT Vol. 150 at 53, 64-66. The Kansas experts then implemented a maximum farm efficiency factor. In due course, after reviewing available evidence and making trial runs of the model using figures between 55 and 75 percent, the Kansas experts selected maximum farm efficiency factors of 65 percent for all of the canal systems except two. Those were set at 70 percent, and the Stateline pumpers were assigned 75 percent. RT Vol. 150 at 76-77; Kan. Exh. 776. In recalibrating the model, the SEV values in the model which determine the noncrop consumptive use of water were also adjusted. RT Vol. 150 at 54-55. It is with the inclusion of these changes that the Kansas updated H-I model calculates depletions to usable flow for 1986-94 in the amount of 91,565 acre-feet. RT Vol. 150 at 48; Kan. Exh. 787.

Colorado did not object, *per se*, to the use of a maximum farm efficiency factor. Nor did it attempt to defend 87 percent as being a reasonable maximum farm efficiency in the Arkansas Valley. Indeed, Colorado had used a factor of 75 percent in its own water budget model. RT Vol. 150 at 49; RT Vol. 151 at 33, 48-51. Moreover, Colorado experts had testified to the 87 percent figure as one of the "deficiencies" attributed to the H-I model during

the liability phase of the trial. RT Vol. 111 at 45-46. RT Vol. 115 at 61; RT Vol. 133 at 101-06. RT Vol. 151 at 102. Through detailed analyses of the H-I model results with respect to each canal system, Colorado experts had uncovered the fact that the effective maximum farm efficiency of 87 percent caused the model under certain conditions to calculate absolutely no deep percolation for an entire canal system. (For example, see Colo. Exh. 997 and Kan. Exh. 770, Vol. I for the Colorado Canal; RT Vol. 151 at 24-28.) Kansas initially had not checked the model results in a similar fashion. RT Vol. 151 at 63; RT Vol. 152 at 9-10.

However, Colorado did object strongly to the change in the maximum farm efficiency as being "selective," that is, a late change that served to increase Stateline depletions while offsetting factors that tended to overestimate depletions were left intact. RT Vol. 152 at 125. In addition, the Colorado experts believed that the maximum farm irrigation efficiency values selected by Kansas for its updated version of the model were not reasonable for the Arkansas River Basin. *Id.* Mr. Schroeder later attempted to remedy what Colorado perceived as this "selective change" by removing the so-called restrictive factors (diversion reduction factors, reduced canal capacities and low WANT factors) from the H-I model. In Colorado's view these restrictive factors tended to cause depletions to be overestimated. RT Vol. 153 at 19. The results of that modeling effort are discussed in Section VII.

A. Kansas' Evidence on Farm Irrigation Efficiency.

To support an appropriate model value for irrigation efficiency, Kansas engaged a new expert witness, C. Eugene Franzoy. His qualifications are found in Kansas Exhibit 785. His experience in agricultural engineering and irrigation efficiencies is extensive, including testifying as an expert witness in a number of cases. The most prominent of these cases was the interstate water dispute in *Texas v. New Mexico*. Currently he is also working on another interstate water case, *Nebraska v. Wyoming*, which he said was "similar to this case." RT Vol. 150 at 88. His experience in performing field evaluations of irrigation efficiencies ran into the hundreds. RT Vol. 157 at 17-18.

His first field trip through the area was in January, 1996, at a time when no irrigation was occurring. Nonetheless, he was able to observe the general topography and field slopes, the types of soil, the size and configuration of fields irrigated by the various canals, the irrigation methods used, and the presence of any return flow reuse systems. Kan. Exh. 774. Soil survey maps provided by the United States Natural Resources Conservation Service, formerly the "Soil Conservation Service," were also used, together with data on irrigated acreage by canal service areas and crop distributions. The results of his initial work are found in Kansas Exhibit 774.

The purpose of his initial work study was to determine the achievable on-farm efficiencies of farms in the Arkansas Valley. For purposes of his report, he defined achievable efficiency as the "maximum on-farm efficiency achievable for the existing physical conditions, assuming

a high level of management." Using this definition, efficiency becomes "a measure of the ability of the soil to absorb and retain sufficient water for crop use given the existing intake rate, slope, topography and field length." *Id.* at 3. In more specific terms, the irrigation efficiency is the percentage of applied water that is consumed by the crop. RT Vol. 150 at 45. For example, if the farm efficiency were 65%, it would mean that 65% of the applied irrigation water was consumptively used by the crop, and the remaining 35% either percolated to groundwater, or ran off the farm as tailwater. RT Vol. 150 at 111-112.

In Mr. Franzoy's opinion, achievable efficiencies in this case were largely determined by the soils and slope of the fields. However, he felt that "slope was the dominant factor, because the soils are close enough to be the same." RT Vol. 150 at 115, 120. Mr. Helton agreed that slopes were "a controlling factor." RT Vol. 152 at 130. Of course, there are also other factors that influence irrigation efficiencies, for example, the type of crop, the depth of the rooting system, the presence of salts or silt in the irrigation water, the type of irrigation system, and the available water supply. RT Vol. 150 at 118-19; Kan. Exh. 774 at 10.

Mr. Franzoy characterized the topography of the Arkansas River Valley as rolling terrain, sloping toward the river on both sides and also towards several tributary drainage areas. Kan. Exh. 774 at 10; Kan. Exh. 801 at 5-6. The soils were relatively flat in the bottom of the valley

along the river, but slopes reached 2 percent at the edge of the irrigated areas.[7]

Kan. Exh. 774 at 2, 10. The majority of the areas farmed had slopes exceeding 0.5 percent. *Id.* at 10. Soil Conservation Service data confirm Franzoy's slope estimates. *Id.*, Table 2. Above slopes of 0.5 percent, Franzoy testified that irrigation efficiencies decrease. *Id.* at 14; RT Vol. 159 at 151. In his opinion, irrigation water would be difficult to control in most of the valley because of slopes that were greater than 0.5 percent and ran both parallel and perpendicular to the direction of irrigation. Kan. Exh. 801 at 5. Franzoy's estimates of the "on-farm" efficiencies achievable in each of the canal systems are found in Kansas Exhibit 774.

In April 1996 Mr. Franzoy again toured the valley, this time when crops were being irrigated. His specific purpose was to look at tailwater, and the opportunities for reuse of tailwater within a canal system, and to estimate irrigation efficiency on a system-wide basis as opposed to individual farms. RT Vol. 156 at 131-32; RT Vol. 157 at 61. The maximum farm efficiency factor in the H-I model operates on a canal system as a whole.

As a result of this additional work, Franzoy estimated the reuse of tailwater for each canal system, and increased his original irrigation efficiencies for seven of the canals. Kan. Exh. 801, Table 2. He testified that it is not easy to estimate maximum farm efficiency "on a ditch-wide" basis, and that more judgment is involved

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[7] A one percent slope equals a one-foot change in elevation over 100 feet of distance. RT Vol. 150 at 151.

than in measuring efficiency on an individual field. RT Vol. 157 at 62. Even so, in his opinion, a maximum irrigation efficiency of 87 percent was not reasonable, and 75 percent was high. RT Vol. 150 at 136. "You are not going to hit 75 percent over an entire season . . . " RT Vol. 159 at 166-67 (Franzoy). Mr. Franzoy's estimates in Table 1 of Kansas Exhibit 801 were based on achievable efficiencies over an irrigation season. RT Vol. 156 at 135; RT Vol. 159 at 148, 166. Mr. Franzoy testified that he reviewed his conclusions with Brice E. Boesch of the Natural Resources Conservation Service (formerly the federal Soil Conservation Service) who also disagreed with 75 percent, and thought that Franzoy's figures were "reasonable." RT Vol. 160 at 22; Kan. Exh. 774 at 12. Mr. Helton also called Boesch, but only to verify Franzoy's contact. Helton did not solicit Boesch's substantive views. RT Vol. 159 at 19-21.

Mr. Franzoy's April tour produced a number of photos showing considerable amounts of tailwater in washes and drains, and ponded at the lower ends of fields. Kan. Exh. 801. These pictures did not support the Colorado claim of extensive reuse of tailwater, even in the "water short ditches."[8] However, Mr. Helton pointed out that April of 1996, at the time of Franzoy's tour, was unusual in that water was being released from storage in order to gain reservoir space for flood control purposes. RT Vol. 158 at 31. The month was not representative of water short conditions, he said. RT Vol. 159 at 128. For example,

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[8] The Amity, Colorado, Fort Lyon, Holbrook and Otero Canals. Colorado emphasized tailwater reuse in these systems because of their general need for more water.

he testified that Fort Lyon diverted 22,622 acre-feet in April contrasted with an average of 12,501 acre-feet for the 1950-85 period. RT Vol. 159 at 127. Other evidence, however, indicated that April 1996 was not that unusual. During the 1986-94 period, Fort Lyon's April diversions exceeded the 1996 amount in four of the nine years. *Id.* at 128-30. Moreover, when Franzoy was there on April 23-24, Fort Lyon was calling for more water under its 1887 second priority, which meant that it was not "getting all the water it needed." Kan. Exh. 850; RT Vol. 159 at 32-35.

B. Colorado's Evidence on Farm Irrigation Efficiency.

Colorado's evidence on this subject was presented through two experts: Duane D. Helton and Prof. Robert E. Walker. Mr. Helton has been a chief expert for Colorado throughout the trial, and his 27 years of experience along the Arkansas River clearly make him the most knowledgeable witness about conditions generally in the Arkansas River Valley. Professor Walker was a new expert witness who has been in the agricultural engineering department at California Polytechnic University, San Luis Obispo, for the last 13 years. RT Vol. 158 at 45. He is a full professor at that university.[9] Prof. Walker also has had personal experience with irrigation in the Arkansas Valley. He was employed from 1972 to 1976 by Foxley and Company (a large cattle feeding operation) and was responsible for the irrigation of about 3500 acres in the

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[9] His resume appears in Colo. Exh. 1053.

Colorado Canal system. RT Vol. 158 at 47-48. Prior to that time, in 1968-72, he worked for the Soil Conservation Service in Southern California. However, he had never testified before as an expert witness on irrigation efficiency. *Id.* at 51.

The primary thrust of Mr. Helton's testimony was that Franzoy had failed to give sufficient recognition to the extensive reuse of tailwater, and the practice of deficit irrigation in the Arkansas River Valley. Even with the adjustments that Franzoy made after his April inspection, Helton believed that the Kansas efficiency percentages were still low, and that the maximum irrigation efficiency factor in the H-I model for use during 1986-94 should be 75 percent.

Helton and Prof. Walker also made an inspection tour of the valley in September 1996. RT Vol. 157 at 125. Because of the access they enjoyed as Colorado experts to go on certain Colorado farms, they were able to see features not visible to Franzoy. They too introduced a large number of photographs and maps, concentrated primarily in the Bessemer, Fort Lyon and Amity Canal Systems. Colo. Exh. 1055, 1056, 1056 B-E. These exhibits were intended to demonstrate in part the use of tailwater from one field as irrigation supply to the next lower field. Sometimes Mr. Helton referred to this as the "multiple reuse" of tailwater, and sometimes as examples of water being "successively used." RT Vol. 157 at 152, 164-65, 182; RT Vol. 158 at 24; RT Vol. 152 at 126-27; Colo. Exh. 1055, photo 23 D. The evidence suggested as many as seven fields where water could be successively used. RT Vol. 157 at 164-65. Later testimony, however, by both Mr. Franzoy and Prof. Walker, showed that tailwater from one

field that is used as part of the irrigation supply of a lower field is essentially consumed in that first reuse. RT Vol. 159 at 145-47, 149; RT Vol. 15` at 119-22. Franzoy found references to the "multiple" reuse of tailwater to be misleading. RT Vol. 159 at 149.

The practice of deficit irrigation was acknowledged to be prevalent in the Arkansas River Valley. When a full irrigation supply is not available, farmers tend to under-irrigate a lower field or portion of a field, and accept the consequent reduction in crop yield. This is particularly true of alfalfa, a major crop in the valley, which can withstand a water shortage and still recover with a full yield when more water again becomes available. Mr. Helton cited the practice as another demonstration of Colorado's efficient use of a limited water supply. But as Mr. Franzoy pointed out, the major impact of deficit irrigation is to reduce tailwater runoff as opposed to a reduction in deep percolation losses. RT Vol. 159 at 160-61. In that sense, it runs counter to Colorado's attempt to establish a high irrigation efficiency based on tailwater reuse.

Mr. Helton also pointed to certain engineering reports and court approved water transfers that he believed tended to support his 75 percent efficiency figure. The actual percentages in each of these sources was lower than 75 percent, but he testified that certain adjustments were required in order to allow a comparable comparison. With these adjustments, Mr. Helton said that the following irrigation efficiencies were comparable to his 75 percent: 68.8 percent for a Colorado Canal transfer, 70 percent for a Rocky Ford Canal transfer, 72 percent for a proposed transfer in the Keesee Ditch, and 75 percent

for a transfer in the Fort Lyon Canal. RT Vol. 159 at 53-58, 100, 109-11, 116-17; Jt. Exhs. 79, 80, 156.

Colorado law permits the transfer only of the consumptive use portion of a diversion right. That is, the law protects the return flows to the stream system, and does not allow the transfer of tailwater runoff, deep percolation, or canal and lateral seepage. RT Vol. 159 at 45-46. These irrigation efficiency estimates are a way to reach the approximate amount of water actually consumed by the crop in a particular transfer situation. In the H-I model, the maximum farm efficiency value is not the same as a one-time highest efficiency that can be measured in a ditch system. RT Vol. 157 at 109-11. The factor in the model determines the maximum amount of water, on a monthly basis, over an entire user service area, that is made available for use by the crop. *Id.*

Mr. Helton was faced with the testimony of a prior Colorado witness who expressed a different opinion on the irrigation efficiencies of the various canal systems. Donald L. Miles was an expert witness for Colorado during the liability phase of the trial. His complete testimony embraced a variety of subjects (e.g., pump efficiencies, salinity, subirrigation, winter irrigation practices) but a significant segment dealt with irrigation efficiencies. RT Vol. 66 at 8-47, 91-96. Mr. Miles was extremely well qualified, having been born and raised along the Arkansas River, and having been employed from 1973 to 1988 by Colorado State University as its extension irrigation engineer stationed at Rocky Ford. RT Vol. 65 at 123-25. His job was to work with farmers along the Arkansas River in Colorado to improve their irrigation practices and water resource management. *Id.* at 134-36.

Mr. Miles estimated the farm irrigation efficiencies for most of the canal systems, with the range varying from 30 to 70 percent. The water short canals, with which Colorado was most concerned, fell between 50 and 65 percent, except for the Colorado Canal at 70 percent. RT Vol. 66 at 91-96; Kan. Exh. 772. Mr. Helton pointed out appropriately that Miles' figures were average values, not the maximum efficiencies used in the H-I model. RT Vol. 66 at 145, 150. Mr. Franzoy also recognized that these were estimates of actual as opposed to achievable efficiencies, although in the water short ditches he thought the values were close and would be comparable. RT Vol. 157 at 87-88; Kan. Exh. 801 at 6.

Mr. Miles also spoke about the "clear water effects" resulting from the construction of Pueblo Reservoir, which removes much of the silt from the River leaving clear water to be released for irrigation. Colo. Exh. 89 at 43-44. Clear water soaks into the soil at the upper end of the field much more easily than muddy water. *Id.* With more silt, the mud tends to seal the furrows at the upper end of the field. But with clear water, the sealing effect does not occur, and it is often difficult to keep from over-irrigating the upper end of the field, reducing the irrigation efficiency. RT Vol. 65 at 161-64. In Mr. Miles' opinion the increase in seepage, in the canals and on the farms, from the use of more clear water had been "very significant" in the river reach between Pueblo and John Martin Reservoirs. *Id.* at 168-71. Entirely apart from the clear water effect, Miles testified that it was fairly common practice to run water for about 12 hours, 9 or 10 of which would be required to get the water through the field. As a

result, "the lower end of the field is usually under-irrigated, while the upper end is often over-irrigated." Colo. Exh. 89 at 43.

Prof. Walker did not have an opinion on what the maximum farm irrigation efficiency values should be, although he thought that Mr. Franzoy's estimates were flawed and that his numbers should be moved upward. RT Vol. 158 at 93. Asked whether he thought Franzoy's adjustments of about 5 percent made for tailwater reuse were sufficient, he said that he didn't feel "qualified to really quantify that." *Id.* at 93. Asked specifically whether he believed that Franzoy's percentages in Kansas Exhibit 801, Table 1, were "realistic or appropriate," he replied that all he could rely upon was his Foxley experience where he personally measured an efficiency of 80 percent. *Id.* at 150. That was a summer measurement, however, and an earlier spring measurement that he made showed an efficiency of between 20 and 30 percent. *Id.* at 151-52.

Professor Walker apparently did not fully understand Franzoy's two reports, and the reasons for his efficiency percentages. Professor Walker was of the opinion that Franzoy had based his numbers on "border strip irrigation,"[10] and that using the 0.5 percent limit developed for

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[10] Border strip irrigation is where the field is confined by ridges and the area between the ridges is filled with a sheet of water. RT Vol. 158 at 128. There was no evidence that this type of irrigation was prevalent in the Arkansas Valley. The predominant irrigation methods were furrows and corrugations. Colo. Exh. 1053 at 1.

border strips could underestimate the maximum achievable farm efficiencies for furrow corrugation[11] irrigation "by as much as 10 to 15 percent." Colo. Exh. 1053 at 1. In support of his opinion, Professor Walker could point to only one reference in Franzoy's first report (Kan. Exh. 774 at 12) where the term "border strip" was even mentioned. RT Vol. 158 at 130-32. Franzoy's second report had no reference at all to border strip irrigation, and Professor Walker had not reviewed Franzoy's earlier testimony. *Id.* at 130, 132. In fact, the only references in Mr. Franzoy's initial report were merely part of his literature review which mentioned a 1983 article and a 1995 paper to the effect that border strip irrigation is best suited to slopes of less than 0.5 percent. Kan. Exh. 774 at 12. These references give no support to Professor Walker's opinion, and Mr. Franzoy testified that Professor Walker's assumption was not correct. RT 159 at 150.

Moreover, Professor Walker seemed to confuse the data shown on Franzoy's Table 1 of his second report. Kan. Exh. 801. A copy of that Table is included as Exhibit 8 in the Appendix. He finally acknowledged, "I misinterpreted, then, what he [Franzoy] was saying." RT Vol. 158 at 137. He seemed to assume that Column (1) in Table 1 represented Franzoy's estimate of efficiency based on a 0.5 percent slope; that Column (2) then depicted the actual slope; and in Column (3) Franzoy downgraded the

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[11] A corrugation is simply a depression forced by a skid or roller into otherwise flat ground. RT Vol. 66 at 139. In Mr. Miles' opinion it results in "very inefficient irrigation," though it is used on "quite a lot of the acreage" in the Fort Lyon system. *Id.* at 140.

efficiency to the extent that the slope exceeded 0.5 percent. Professor Walker used the Bessemer Canal as an example: he said Column (1) showed a maximum efficiency of 55 percent; Column (2) listed the dominant slopes at 0.5 and 1.0 percent; and Column (3) Franzoy therefore downgraded the 55 percent efficiency to 35 to 50 percent. RT Vol. 158 at 135-137. Clearly this was not a correct interpretation of the Table. Franzoy's estimate of maximum system efficiency was shown in the far right column, not in Column (3), and for Bessemer the estimate was actually 60 percent. The figures in Column (3) came from the Soil Conservation Service data sheet "for graded furrow and sprinkler" irrigation, as the footnote plainly showed. Column (3) was obviously inserted for comparison purposes, but those percentages were not Franzoy's opinion; nor did they represent a reduction of Column (1) figures because of slope.

In Professor Walker's opinion, "good management compensates for different slopes." RT Vol. 158 at 98. He testified that good management can handle tailwater on a one percent slope, and that a good farmer can farm a one percent slope just as easily as a 0.3 percent slope. RT Vol. 158 at 99, 145, 146. However, there is nothing cited in the literature to support this view; nor did Professor Walker show specifically how this could be done. Mr. Franzoy disagreed that management could "fully compensate" for slopes over 0.5 percent, and he cited examples. RT Vol. 159 at 150-59. With Arkansas Valley soils, and a slope of one percent, Franzoy said the inherent irrigation efficiency is about 40 percent. But applying proper irrigation management such as scheduling, alternate row irrigation, and tailwater reuse, Franzoy testified efficiency could be

boosted by 10 to 20 percentage points, but not up to 75. *Id.* at 151-52. As the slope increases, so does the velocity of the water, and the depth of the water in the furrow will go down. *Id.* at 151. Erosion is one of the reasons that management cannot overcome all of the effects of slope. *Id.* at 156. That is why farmers sometimes go to the major expense of land leveling. *Id.* at 154, 157. I conclude that Mr. Franzoy's opinion, which also finds support in the Soil Conservation Service material, is the more realistic view of achievable irrigation efficiencies. *Id.* at 156-58; Kan. Exh. 801, Table 1.

C. Conclusion.

A clear analysis of the maximum farm irrigation issue is handicapped by differences in definition, in the use of the term "maximum" compared to the way in which the H-I model applies the factor, and the concept of a "ditch-wide" efficiency as opposed to a traditional individual field efficiency. Nonetheless, I have concluded that for the period 1986-94 the percentages utilized by Kansas in its updated version of the H-I model for the various canal systems are the values that should be used.

Mr. Helton acknowledged that his recommended 75 percent for all canals was a "relatively high maximum farm efficiency." RT Vol. 159 at 108-09. In part, he did this to account for the use of tailwater delivered from one canal system into another. *Id.* at 18. For example, tailwater drains from the Fort Lyon system empty into the Amity Canal, becoming part of Amity's supply. RT Vol. 157 at 173-74; RT Vol. 158 at 28-29. Such reuse of tailwater is not accounted for in the H-I model, which Helton saw

as a shortcoming of the model. RT Vol. 159 at 13, 15-16, 107-08. Consequently he thought that use of a 75 percent factor was a way in which such tailwater could be "incorporated into the modeling process," although such tailwater use does not affect irrigation efficiency. RT Vol. 159 at 18, 107-09; RT Vol. 157 at 101. But if this is a modeling deficiency, it should be addressed directly rather than attempting to compensate through the use of another erroneous factor.

It should also be noted that the uniform 75 percent factor is not supported by Colorado's earlier expert witness on this subject. Don Miles varied his estimates of irrigation efficiencies among the various canal systems, and the Kansas factors used in the updated H-I model in each instance equal or exceed Miles' percentages. Colorado, in its new Use Rules, has also adopted a presumptive depletion factor of 75 percent for sprinkler irrigation. That is, it is presumed that only 75 percent of the irrigation water applied by sprinklers is consumptively used by the crop, with 25 percent returning to the river system. Yet there is no doubt that furrow irrigation, which predominates in the Arkansas Valley, is less efficient than using sprinklers and results in greater losses and a lower percentage of use by the crops. RT Vol. 157 at 114, 122.

SECTION VII

SCHROEDER'S MODIFICATIONS TO THE H-I MODEL

In his testimony during the March 1996 segment of the trial, Mr. Schroeder said he thought that he could develop a "more appropriate" version of the H-I model than the competing versions then being used. RT Vol. 152 at 74. And during the spring and early summer of 1996 he set out to do so. The results of his work were presented when the trial reconvened on September 30, 1996.

Mr. Schroeder wanted to address the previous criticisms which Colorado experts had made, particularly the removal of parameters that were not based on physical facts, that is, the so-called restrictive factors. These were the diversion reduction factors, limitations on canal capacities, and the imposition of WANT factors, all of which controlled under certain conditions. Mr. Schroeder had attempted these modifications once before during the liability phase, but the results then were unacceptable even to him. Colo. Exh. 1011, 1012; RT Vol. 139 at 67, 96; RT Vol. 140 at 97.

The new Schroeder version was referred to as "Colorado's August 1996" H-I model. RT Vol. 154 at 22. Not unexpectedly, Mr. Schroeder's modifications removed the diversion reduction factors; set the WANT factors at values consistent with a demand for a full water supply; and adjusted the canal reduction and SEV factors. Colo. Exhs. 1047, 1048. Mr. Schroeder used the Kansas values for maximum farm efficiency, except for the five water short canals which were increased to 75 percent. *Id.*; Colo. Exh. 1046; RT Vol. 154 at 126-27.

The results of the Colorado August 1996 H-I model showed depletions to usable Stateline flow for the period of 1986-94 of 19,700 acre-feet. Colo. Exh. 1047 at 3. By way of comparison, this version of the model calculated depletions to usable flow for the 1950-85 period at only 282,000 acre-feet, although the states had stipulated earlier to 328,505 acre-feet for the 1950-85 period. *Id.*

On cross-examination Mr. Schroeder agreed that he had made a "fundamental change" in the H-I model. RT Vol. 154 at 124. By striking the restrictive factors, his intent was to "represent the priority system as it really exists." *Id.*; RT Vol. 155 at 8. But Kansas said this "changed the whole approach of the model, which is to match diversions" of the Colorado ditches.[12] RT Vol. 154 at 124. Kansas experts testified that the H-I model does not function if the diversion reduction factors are removed. "You end up with overpredicted values [for diversions] and underpredicted streamflows." RT Vol. 151 at 122; RT Vol. 150 at 81-82. Generally, if diversions are overpredicted, Stateline depletions are reduced. RT Vol. 155 at 24-25.

Mr. Schroeder found that the structure of the H-I model did indeed require some limitation on canal capacities. The Amity Canal, for example, had a physical capacity of about 800 cfs, but initially he set the model capacity at 435 cfs. RT Vol. 155 at 55; RT Vol. 154 at 125. In the summer of 1996 he then changed that value to 625 cfs,

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[12] The H-I model predicted diversions rather than inputting actual diversions as fixed data into the model, so that diversions could vary depending upon pumping from wells. Colorado did not object to this methodology. RT Vol. 155 at 8-11.

based upon an engineering report that Amity's maximum diversion between 1939 and 1985 had been in the range of 600 to 650 cfs. RT Vol. 155 at 58. The result of that single change reduced Stateline depletions of usable flow for the 1986-94 period by 4000 acre-feet.[13] *Id.* at 23-24. However, the change caused the model to show diversions which in fact had not occurred historically. *Id.* at 59. The maximum rate of diversion into the Amity Canal, was 435 cfs during 1986-94, and that rate held for only a single day in those nine years. *Id.* at 12, 52-53; RT Vol. 168 at 6. Mr. Schroeder's increase in Amity's canal capacity to 625 cfs left the model less able to match predicted and actual diversions, and in December 1996 he testified that he was "about to do a full circle." RT Vol. 168 at 8. That is, he then believed that the 625 cfs capacity should be reduced back to 435 or 456 cfs. *Id.* at 7-8. At one point he said, "I think without major structural changes, starting over, I don't know that I can improve much on this model." RT Vol. 154 at 144.

The Colorado August 1996 H-I model was seriously in error with respect to predicting diversions for the Amity Canal, which is the largest system between John Martin Reservoir and the Stateline. For the 1986-94 period this version of the model overpredicted the Amity diversions by approximately 340,000 acre-feet, or by 40 percent. RT Vol. 155 at 12-13. In three of the nine years the overprediction was in excess of 60 percent. *Id.* If the model overpredicts diversions, the tendency is to reduce Stateline depletions. RT Vol. 155 at 24-25.

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[13] Colorado's estimated depletions of 19,700 acre-feet for 1986-94 included the 625 cfs capacity for the Amity Canal.

Still, in Mr. Schroeder's final opinion the Colorado August 1996 H-I model was "more reasonable and appropriate" to use than the Kansas March version. RT Vol. 154 at 89, 136. Yet it must be noted that in 1992 Mr. Schroeder also modified the H-I model to remove the restrictive factors, with calibration results that compare favorably with Schroeder's August 1996 version of the model. Colo. Exhs. 1010, 1047; Kan. Exh. 843. His testimony at the time was that the 1992 modified version was not an appropriate or reasonable tool to use. RT Vol. 139 at 67, 96; RT Vol. 154 at 144. In fairness to Mr. Schroeder, however, the 1992 and 1996 versions were not identical, even though the restrictive factors had been removed from both. RT Vol. 154 at 144-45; RT Vol. 155 at 72-74. Moreover, his earlier testimony may have been aimed more at preventing reliance on the model in connection with the Winter Water Storage Program, and the Spronk usable flow analysis. RT Vol. 155 at 65-66.

In Mr. Schroeder's view it was most important to accurately represent the Colorado priority system in the modeling effort. RT Vol. 155 at 21, 67. He believes that the restrictive factors compromise this goal and bias the results with respect to depletions. His changes were driven by the Colorado priority system, even though such changes might not result in a better fit between predicted and observed data. *Id.* at 72. On the other hand, the Kansas expert (Steven Larson) testified that the "most important element" in the modeling process was to try to replicate actual measured data, particularly with respect to streamflows, diversions and reservoir storage. RT Vol. 155 at 91. Mr. Larson said the accuracy of the model in regard to these conditions is an indirect measure of its

ability to calculate depletions. *Id.* at 92. The restrictive factors in the model were not ideal, but were necessary in view of the limitations on available data. RT Vol. 156 at 46. These different approaches marked the essential distinction between the Kansas and Colorado versions of the H-I model, in its latest forms.

In Mr. Larson's opinion, the Kansas March version of the H-I model, using the Colorado pumping figure, gave the "more accurate" results. RT Vol. 155 at 88. I believe the evidence supports this conclusion. Kansas presented a series of exhibits comparing the performances of the Kansas and Colorado versions of the model. Kan. Exhs. 789-799. These comparisons analyzed predicted model results against actual measured values with respect to streamflows, diversions and reservoir storage. They looked at different periods of time, e.g., 1950-85, 1986-94, 1950-94. They examined seasonal accuracy, comparing summer irrigation periods with wintertime data. And they separated the reach of the river system upstream from John Martin Reservoir from the downstream area between the Reservoir and the Stateline.

The statistical analyses included in these exhibits removed certain "outlier" flows from both the predicted and observed totals.[14] Only the three months in 1987 were challenged by Colorado. Flows during this period

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[14] These were months of May and June, 1951; June-September, 1965; April-June, 1985; and April-June, 1987. RT Vol. 155 at 41-42; RT Vol. 156 at 14, 26-27. In its comparative exhibits, Colorado excluded 1951 and 1965 entirely, but did not remove the three high flow months in 1987. RT Vol. 155 at 46-48, 82; RT Vol. 156 at 26.

amounted to 352,000 acre-feet, about 50 percent higher than the highest full year, other than 1987, during the 1986-94 period. RT Vol. 156 at 14-15. Mr. Larson explained that it was important to assess the model's performance within a normal operating range, not at the extremes. Abnormally high flows during 3 months out of 108 months could easily mask the model's real accuracy, whether good or bad. RT Vol. 156 at 117-19.

For the most part, the Kansas March version of the H-I model demonstrated a closer correspondence between predicted and actual conditions than the Colorado August 1996 H-I model. For the full 1950-94 period of time, both models did a similarly good job of predicting monthly Stateline flows. RT Vol. 156 at 9-10. But examining the Colorado results on a seasonal basis, it is evident that the Colorado model consistently underpredicts streamflow in the summer and overpredicts flows in the wintertime. Kan. Exhs. 789, 790 each at page 9. Summer flows were underpredicted on average by 10 percent and winter flows were overpredicted by 34 percent for 1950-94. *Id.*; RT Vol. 155 at 132. The Colorado model also generally underpredicted streamflows in the early years (1950-73), catching up by overpredictions in the later period (1974-94). RT Vol. 155 at 106; Kan. Exh. 792.

Mr. Schroeder's version of the H-I model also overpredicted diversions by the various Colorado canal systems. An inherent tendency in the H-I model toward such overpredictions was exacerbated when Colorado removed the restrictive factors in its August 1966 version of the model. For 1950-94, upstream diversions were

overpredicted by 11 percent, and downstream by 30 percent. Kan. Exh. 789, 790 at pages 11. The result is to reduce Stateline depletions. Mr. Larson acknowledged that the restrictive factors in the model restrain model diversions under certain conditions to amounts less than actual diversions. However, he said at other times model diversions exceed actual amounts. RT Vol. 156 at 41, 45, 101. The goal is to predict total diversions as accurately as possible, and the Kansas version of the model, with restrictive factors in place, clearly does a better job in this respect than the Colorado August 1996 version. Predicting diversions is a "very important component" of the H-I model. RT Vol. 155 at 100. Predicted diversions that are too high cause groundwater return flows to be overestimated, which in turn result in the overprediction of winter streamflows. RT Vol. 156 at 30. The large downstream error is of special concern because of its greater ability to affect Stateline conditions. RT Vol. 155 at 103-04; RT Vol. 156 at 28, 122.

With respect to reservoir storage, the Kansas model again shows a closer correspondence to actual figures than the Colorado version. For 1950-94 Colorado underestimated measured storage in John Martin Reservoir by 19 percent, and by 16 percent for 1980-94. Kan. Exhs. 789, 790 each at page 13. Kansas model predictions for the same periods were a plus 10 percent and 4.5 percent, respectively. *Id.*

A Colorado exhibit comparing predicted with actual average Stateline flows for the 1986-94 period showed the Colorado August 1996 H-I model surpassing the Kansas version. According to this exhibit, Colorado's predicted flows were only one percent under observed flows, while

Kansas was off by a minus eight percent. Colo. Exh. 1047, Tables 2 and 4; Colo. Exh. 1049. However, in this comparison, Colorado included the three high flow months in 1987. If these three months are removed from the statistical analysis, as I believe they should be, then the Colorado model overpredicts by 9 percent while the Kansas version still underpredicts, but by a smaller amount, that is, by 5 percent. Kan. Exhs. 789, 790 each at page 9. Even without the removal of the three high flow months, the Kansas model is more accurate in predicting Stateline flows in six of the nine years during the 1986-94 period. RT Vol. 155 at 27, 33.

SECTION VIII

STATELINE DEPLETIONS FOR THE PERIOD OF 1986-94

Depletions for the time period considered during the liability phase of the trial, i.e., 1950-85, were agreed to by stipulation. These depletions amount to 328,505 acre-feet. For the period of 1986-94, however, depletions to usable Stateline flow were vigorously contested. The amounts of claimed depletions were calculated variously at 98,637 acre-feet, 91,565 acre-feet, 30,700 acre-feet, and finally at 19,700 acre-feet. The highest amount was based on Kansas' initial estimate of the pumping in Colorado, but was revised downward to 91,565 when Colorado's pumping estimates were accepted. The amount of 30,700 acre-feet was Colorado's estimate based on the "Colorado updated H-I model," which differs significantly from the Kansas version only in that it does not include Kansas' new maximum farm irrigation efficiency factors or changes to John Martin Reservoir operations. The lowest amount of depletions was based on the Colorado August 1996 (Schroeder) version of the H-I model.

Once the pumping figures were agreed upon, the amount of depletions for 1986-94 turned largely on the maximum irrigation efficiency factors, and the question of whether to rely upon the Kansas March version of the H-I model, using Colorado's pumping figures, or upon the Colorado August 1996 version. For the reasons stated in the earlier sections of this Report, I have concluded that the evidence supports the use of the Kansas model. On that basis, I recommend that depletions of usable Stateline flow for the 1986-94 period be determined to be 91,565 acre-feet.

SECTION IX

COLORADO'S COMPLIANCE ACTIVITIES

Bringing Colorado into current compliance with its compact obligations has been a major focus at each of the trial segments since the Court's May 15, 1995 Opinion on liability. Initially, I denied Kansas' motion to enjoin the State of Colorado from pumping more than 15,000 acre-feet annually [i.e., the amount of allowable precompact pumping]. The reasons for denial are set forth in Exhibit 3 in the Appendix. However, I ordered Colorado on August 11, 1995 to prepare a detailed report on the actions "being taken by and within Colorado to comply with the Arkansas River Compact," and to provide that report to Kansas by September 29, 1995.

The report required by this order became Colorado Exhibit 1018. The State Engineer then updated Colorado's efforts by an Addendum No. 1 dated February 23, 1996 (Colo. Exh. 1019) and Addendum No. 2 dated July 12, 1996 (Colo. Exh. 1051). These reports, and the extensive testimony of the Colorado State Engineer and others, show a most impressive record in beginning to control postcompact pumping. Kansas has certain concerns about whether the program will, in fact, prevent further State-line depletions, and points to a number of claimed shortcomings. These are discussed in Sections X and XI. Nonetheless, given the ineffectual and frustrating history of Colorado's previous efforts to regulate wells, the State's current progress is quite remarkable.

Colorado's compliance program is built around two sets of rules promulgated by the State Engineer in accordance with the State's administrative procedures, and

ultimately approved by the Courts. These are the "Measurement Rules," adopted in 1994, and the "Use Rules" which were published in September 1995, and ordered by Judge John E. Anderson, III, the water judge for Water Division 2, to become effective on June 1, 1996. Colo. Exh. 1018, Appendix B; Colo. Exh. 1051 at 4. These rules, and the Kansas views concerning them, are fully discussed in Sections X and XI. However, the essence of the Use Rules is to completely prohibit postcompact pumping (with the exception of the 15,000 acre-foot precompact allowance) unless replacement water is provided to offset depletions of usable Stateline flow.

Beyond the adoption of these Rules, the State Engineer has also concentrated on obtaining better well data. One of the major issues in the liability phase of the trial concerned the number and location of irrigation wells in Colorado, and the amounts of water pumped. Most of the wells were constructed at a time when no prior state permit was required, and until 1994 no general state system existed for the reporting of well pumping. In 1994 the State Engineer set about to remedy the situation. This was after my draft report on liability had been issued [February, 1994] but well before the report was confirmed by the Supreme Court in May of 1995. The State Engineer began a field inventory of all wells covered by the Measurement Rules, that is, all wells included in the area modeled during the liability phase of the trial,[15] together

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[15] This includes irrigation wells in the valley-fill and surficial aquifers, from Pueblo to the Stateline, with a capacity of 50 gpm or more. In its Water Budget, Colorado had originally

with certain additional areas. The field inventory was essentially complete by early 1996, and the field information has been entered into a computer database. Colo. Exhs. 1018 at 8-10, and 1051 at 7. Each well has been assigned a structure identification number with a metal tag affixed to the well as a permanent marker. Data obtained include information on ownership, location, power source and account numbers for each well. The database now covers approximately 2551 wells along the Arkansas River between Pueblo and the Stateline. Colo. Exh. 1051 at 7. All of these data have been made available to Kansas.

The legislature has steadily added funds to implement the State Engineer's enforcement program. In 1993-94 he received budgetary authority for 3.5 additional full time employees, and the number was increased each year to 17.50 for 1996-97. Colo. Exh. 1019 at 4. All authorized personnel have been hired, and Mr. Simpson believes that he has sufficient resources to administer and enforce the compliance program. Colo. Exh. 1051 at 15; RT Vol. 146 at 95. The legislature has also authorized the Colorado Water Conservation Board to loan up to $3,750,000 for the purchase of replacement water and water rights, and another $50,000 has been made available to enhance the system for the electronic transfer of power data. Colo. Exh. 1051 at 2, 15.

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included only wells having a capacity of 100 gpm or more, although Kansas used a threshold of 50 gpm.

Most well owners are now represented by one of three large associations. These associations have undertaken the responsibility for the preparation of augmentation plans, and the acquisition of replacement water and water rights. These organizations are: the Colorado Water Protective & Development Association ("CWPDA" or the "Brotherhood"); the Arkansas Groundwater Users Association ("AGUA"); and the Lower Arkansas Water Management Association ("LAWMA"). Colo. Exh. 1058. The latter organization includes wells located between John Martin and the Stateline, while the other two represent owners primarily between Pueblo and John Martin Reservoir. RT Vol. 147 at 16-18.

It appears, at least in the near term, that sufficient replacement water is available to offset Stateline depletions of usable flow. LAWMA is beginning the purchase of the XY Canal and the dry-up of its lands. LAWMA has also acquired shares in other canals, and is looking to the purchase of the Manvel Canal. RT Vol. 147 at 16-17, 32. Between 33,000 and 43,000 acre-feet of excess transmountain water are expected to be available from the cities of Colorado Springs and Pueblo for the next 20 years or so. RT Vol. 148 at 65-66. This is not new water to the Arkansas River Basin, but rather water that can be transferred away from irrigation in Colorado and used toward replacement obligations to offset Stateline depletions. *Id.* The current price of replacement water appears to be $8 to $10 per acre-foot. RT Vol. 147 at 96; RT Vol. 147 at 32.

It is evident that the State Engineer now has broad support from the Colorado water users, unlike their reaction to his efforts in the 1960s and 1970s to regulate well pumping. *Fellhauer v. People*, 447 P.2d 986 (Colo. 1968),

Matter of the Arkansas River, 581 P.2d 293 (Colo. 1978). The 1994 Measurement Rules were adopted essentially without opposition, and while the 1996 Use Rules were protested by a few users requiring an eight-day trial, widespread support for the rules came from the canal companies and various user groups. Colo. Exh. 1051, Appendix A.

I believe that Colorado as a state fully comprehends the seriousness of its obligations. In response to a comment from me that the State Legislature should be aware that scarcity of funds would not be an excuse for noncompliance with the compact, Mr. Simpson replied:

> "What I discussed [with the Legislature] was exactly what you said, if the resources weren't made available, an order of the United States Supreme Court would certainly bring that about, and they understood that." RT Vol. 146 at 97.

Certainly the Colorado representatives in the courtroom recognize the demand for prompt compliance.

SECTION X

1994 MEASUREMENT RULES

On March 29, 1994 the Colorado State Engineer adopted Rules and Regulations Governing the Measurement of Tributary Ground Water Diversions Located in the Arkansas River Basin ("Measurement Rules"). These Rules became effective July 15, 1994, after approval by the District Court Water Division 2, in Case No. 94CW12. Colo. Exh. 1018. With limited exceptions, these Rules apply to all wells located in the Arkansas River Basin, not only to irrigation wells. RT Vol. 161 at 35; Colo. Exh. 1052. All such wells are required to install a totalizing flow meter or have a power conversion coefficient ("PCC") determined.[16] The accuracy of meters and the power conversion coefficients must be reverified at least every four years. Annual reports of the amounts of water pumped each month are required, unless a well is certified to be inactive. By July 1996 some 2131 wells within the model domain of this case were in compliance with the Measurement Rules. Of this number, totalizing flow meters had been installed on 185 wells, power conversion coefficients had been determined for 1141 wells, and affidavits of inactive status had been filed for 805 wells for the year 1996. Colo. Exh. 1051 at 8.

Based on the experience gained during one and a half years of operation under the Rules, including a 1995 random field test of the power conversion coefficients for 54 wells, the Colorado State Engineer on February 28,

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[16] The power conversion coefficient, or PCC, is the number of kilowatt hours required to pump one acre-foot of water.

1996 filed certain proposed amendments to the Measurement Rules. These were approved by the Water Court and became effective on June 1, 1996. Colo. Exh. 1019 at 12; Colo. Exh. 1051 at 4-6. The principal changes in the Rules require test measuring equipment to be accurate within plus or minus 2%, replacing the previous 5% standard; require that the standards for power coefficient testing include the pumping drawdown and operating pressure at the time the test is conducted; require a new rating of power coefficients whenever a new or reworked pump and/or motor is installed, or other alterations are made, which would affect the power coefficient; and require the installation of flow meters on compound or certain complex systems, which must be accurate within plus or minus 5% of an independent field measurement using calibrated equipment. Colo. Exh. 1051 at 5-6; RT Vol. 161 at 53-54. Accompanying these changes, the state legislature also enacted SB 96-124 requiring power companies to transmit directly to the State Engineer the records of energy used to pump groundwater. Colo. Exh. 1051 at 3.

A. Measurement by Use of Meters or by the PCC Method.

Colorado has allowed most well owners the option of using either meters or the PCC method to measure and report the amounts of water pumped, although meters are mandatory for non-electric wells (i.e., pumps driven by natural gas, diesel or gasoline) and for wells that are part of a complex or compound system. Colo. Exh. 1051, App. B at 3; RT Vol. 149 at 119. Non-electric wells comprise about 3 percent of the total. RT Vol. 160 at 104. Most

users have chosen the PCC method since it is much less expensive. The cost of installing a meter for a large capacity well was estimated between $500 and $2000, although Kansas' State Engineer acknowledged that one would be "very lucky" to get by for less than $1000. RT Vol. 163 at 42; RT Vol. 149 at 120.

It is the Kansas view that metering is the most accurate way to measure pumping, and that it would be feasible to install a mandatory metering system along the Arkansas River in Colorado. RT Vol. 163 at 66, 75; RT Vol. 162 at 106, 114. It is generally agreed that properly installed and maintained meters have an accuracy rating of plus or minus 5 percent, which to Kansas is an acceptable range. RT Vol. 148 at 6; RT Vol. 162 at 107; RT Vol. 163 at 63, 66. Both states agree that the accuracy of pumping data is important. However, Kansas has remained just short of insisting that Colorado require the installation of flow meters on all wells. RT Vol. 148 at 22; RT Vol. 161 at 57; RT Vol. 163 at 166-67. But neither has Kansas been prepared to accept Colorado's PCC measuring program. Kansas experts testified that the Measurement Rules, as implemented, do not provide the level of accuracy and reliability necessary to determine Stateline depletions. RT Vol. 162 at 106-07; RT Vol. 163 at 11; RT Vol. 161 at 57.

Kansas has reason to be concerned about the accuracy of the PCC readings on an individual well by well basis. A random test of 54 wells in the late summer of 1995 was designed to confirm the accuracy of the PCC values previously submitted by the well owners. A number of problems were uncovered resulting in the February 1996 amendments to the Measurement Rules.

Another test program was then conducted in the spring of 1996 on 64 wells, again to check a measured PCC value against the data in the state files. Of these wells, 26 of the power consumption coefficients measured in the field were within 10 percent of the values previously submitted, and 26 of the comparisons were within an envelope of plus or minus 25 percent. Kan. Exh. 852. The remaining 18 wells involved greater variation, but for specific reasons. *Id.* Mr. Schroeder reported that none of these tests had recorded the discharge pressures, and pumping levels were recorded for less than half of the wells. *Id.* The amended rules now require both. The power conversion coefficient for a well depends upon the depth to water and the discharge pressure of the pump, shorthanded as the total dynamic head. RT Vol. 148 at 12; RT Vol. 149 at 116. For example, the discharge pressure is greater if water is pumped into a closed sprinkler system than if water is discharged into an open furrow system; more electricity may thus be required to produce the same amount of water.

While Colorado's State Engineer Hal Simpson believes in the PCC methodology, he too was dissatisfied with these preliminary test results, although he testified that true comparisons were difficult because of the lack of total dynamic head. RT Vol. 161 at 51. In the summer of 1996, therefore, he invited Kansas to join with Colorado in the design of a pump testing program. Because of Mr. Spronk's death, however, Kansas was unable to respond. RT Vol. 161 at 50-51. Mr. Simpson renewed the offer during the trial, and Mr. Pope, the State Engineer of Kansas, in his turn on the witness stand said they would

be "very interested and very willing to participate." Rt Vol. 149 at 43; RT Vol. 161 at 59; RT Vol. 162 at 110-111.

The reliability of the PCC method to determine Colorado's pumping will be an ongoing subject in future trial segments. RT Vol. 163 at 67-68. It is clear, however, that future tests must demonstrate much improvement in the accuracy of this system of measurement.

B. Measurement Considerations

Totalizing flow meters are required in several other western states. Kansas, for example, has required the installation of meters on more than 15,000 wells. RT Vol. 162 at 97. New Mexico also requires meters in the area affected by its obligation to Texas under the Pecos River Compact. Kan. Exh. 806; RT Vol. 162 at 117-18; RT Vol. 163 at 171. Nebraska also has a "strong metering program" in some areas. Rt Vol. 162 at 116. However, the reliability of metered results first requires inspection to assure proper installation of the meter, and then an "intensive program of operation, maintenance, repair and follow-up calibration." RT Vol. 162 at 79; RT Vol. 163 at 11-12. In Nebraska, it is the servicing of the meter by the state that has been the "key to success." RT Vol. 162 at 116.

Most metering programs call for annual reports, on a self-reporting basis. RT Vol. 162 at 75-77, 105. However, Kansas here seeks compliance on a "real time" basis, that is, as close as possible on a monthly basis. Rt Vol. 163 at 68, 102; RT Vol. 167 at 66. There was no evidence on the feasibility of trying to read meters monthly, if meters were to be required, over the 150 miles or so of the Arkansas River that is involved in this case. Mr. Pope

testified that a system which permitted Colorado well owners merely to self-report pumping data would not be acceptable to Kansas. RT Vol. 163 at 13.

There is also a question of how necessary it is to have well-by-well accuracy in view of the way pumping data is used in the H-I model. The model aggregates all of the pumping within a user area or ditch system. RT Vol. 163 at 69, 72; RT Vol. 164 at 37-38, 40. The *distribution* of that pumping is then estimated. RT Vol. 164 at 40. Thus, pumping data from one well may be high, while another is low. Yet the average of the two might be "right on the button" for purposes of model calculations. *Id.* However, as Kansas notes, the presumptive depletion factors under the Use Rules [See Section XI] are 30 percent for supplemental wells, 50 percent for single source wells, and 75 percent for sprinkler systems, so that the results of pumping an acre-foot of water can be quite different. Additional evidence may be required on this point.

In Mr. Simpson's opinion the Measurement Rules, as amended, will provide data that is "reasonably accurate" and "sufficient" for the purposes of administering the Arkansas River. RT Vol. 148 at 17; RT Vol. 161 at 48. Indeed, he believes that the PCC method is "still the most appropriate way to proceed." RT Vol. 161 at 49. He sees the data improving. RT Vol. 149 at 42. The three larger associations are now using very competent consulting engineers to perform the PCC tests, and 25 percent of the wells will be checked each year. RT Vol. 149 at 42, 49, 55. And the power data are now being electronically transmitted directly to the state by the power companies on a

monthly basis. Simpson expects that the system, if properly administered, should provide results that are accurate within 5 or 10 percent. RT Vol. 148 at 16.

It is true that a power conversion coefficient will change over an irrigation season as groundwater levels drop. But the aquifer in the Arkansas Valley is not declining constantly; it recovers at the end of each year. RT Vol. 161 at 56. Mr. Simpson understood that the majority of tests are done earlier in the season when water levels are higher. If this is true, and if well levels decline later, the PCC results would be conservative. RT Vol. 149 at 109, 111; RT Vol. 147 at 6. That is, the data would tend to overestimate the volume of water pumped because more power would be required to lift the water from greater depths even though the quantity of water produced was the same.

A major advantage of the PCC program is timely data. RT Vol. 148 at 19. The system can be used to estimate pumping during the irrigation season, and to compare that data with the assumptions in the replacement plans. The state can determine if wells claimed to be inactive are in fact being pumped. RT Vol. 149 at 42. The system also has widespread user acceptance, the importance of which should not be taken lightly where prompt compact compliance is being sought. RT Vol. 149 at 42. Farmers are notoriously opposed to meters, and historically in Colorado farmers have not been reluctant to take their complaints to the courts or to the legislature. Of course, it can be argued that the pumpers have accepted the Measurement Rules only because the PCC methodology is their least costly alternative, and they are not necessarily concerned about the accuracy of the results.

But it should be remembered that the Measurement and Use Rules protect not only Kansas, but also the holders of senior surface rights in Colorado. In any event, sufficient accuracy in pumping estimates in order to determine compact compliance will be required, whatever measurement system may finally be used.

C. Conclusions.

Measuring indirectly the amount of water pumped through power usage is a well accepted technique, so long as the required data is accurate. It requires data on the amount of electricity supplied to any particular well, and a field test of the pumping facility to determine quantity of water produced per unit of electricity, known as the power conversion coefficient or PCC. Indeed, this was the methodology used by both states to estimate pumping from 1950 through 1985, although much of the early data, while the best that could be developed, were quite crude. Early power records were missing and had to be estimated through certain mathematical techniques. And the PCC values used throughout the entire liability phase were developed by the USGS during a single study in 1964-68. Jt. Exh. 66.

There is no question that the current Measurement Rules, together with Colorado's improved well database and recent legislation, vastly improve the ability of both states to calculate total pumping. Power data can now be reliably transmitted directly to the Colorado State Engineer on a monthly basis, and these data are available to Kansas. The PCC values, however, remain the critical part of the methodology. Colorado indicates that we may

expect continued improvement in the accuracy of these coefficients, and possibly that will be the result of any testing program developed jointly by Colorado and Kansas, or otherwise. It should be noted that the Kansas Chief Engineer was careful to remind the Court that he had never said that "the PCC method would be unacceptable." RT Vol. 163 at 66. Although it was the Kansas position that a representative sample of 10 percent of the wells should be equipped with meters, and that more than one water level measurement during the irrigation season should be required for all wells. Kan. Exh. 809 at 4-5; Kan. Exh. 810 at 5. The issue is whether the methodology will prove sufficiently accurate for purposes of compliance with the compact, and that question remains open.

However, at the present time, I find no reason to recommend changes in the Measurement Rules.

SECTION XI

1996 USE RULES

The Amended Rules and Regulations Governing the Diversion and Use of Tributary Ground Water in the Arkansas River Basin ("Use Rules") were promulgated by Colorado's State Engineer in September of 1995, and became effective on June 1, 1996 after protest, trial, and approval by the Water Court. Colo. Exh. 1051, Appendix A. The Use Rules are set forth in Colorado Exhibit 1018, Appendix C.

The "Compact Rule" is Rule 3. This Rule provides that all diversions of groundwater for irrigation use, from the valley-fill and surficial aquifers along the Arkansas River from Pueblo to the Stateline, "shall be totally discontinued" unless depletions to usable Stateline flow caused by such pumping are replaced pursuant to a plan approved by the Colorado State Engineer's office. The only exceptions are the precompact wells, which are allowed to pump 15,000 acre-feet annually in accordance with my Report on the liability phase of the trial. Even these wells, however, are still subject to Rule 4 which requires that replacement water be provided in order to protect senior surface water rights in Colorado against depletions. Rule 3.3; RT Vol. 146 at 51. The result is that precompact wells must also be included in an approved augmentation plan.

Depletions to usable Stateline flow are to be determined through the use of the H-I model, and the Durbin usable flow method with the Larson coefficients, "or such other method approved by the Special Master . . . " Rule 3.4. Adoption of the Kansas model reflects Colorado's

decision announced at the first court session following the Supreme Court's decision on the liability phase. RT Vol. 146 at 52, 62. At this point in time, I see no reason why the H-I model should not be utilized, although new data input will be required at least yearly, and other modifications will be needed to incorporate the augmentation plans. RT Vol. 164 at 149, 151; RT Vol. 147 at 34.

Rule 4 responds directly only to the protection of senior surface water rights in Colorado, although Mr. Simpson believes that implementation of Rule 4 will also "protect the depletions to state line flow." RT Vol. 147 at 127. It has the "derivative effect" of benefitting Kansas. *Id.* at 130. However, if this is not true, Rule 4.1 still provides that replacement water supplied to protect Colorado senior rights "shall not relieve a well user of an obligation to replace depletions to usable Stateline flow." Rule 4.1; RT Vol. 146 at 61.

The Rules establish certain "presumptive stream depletions" which are used to determine depletions to the Arkansas River caused by well pumping. For wells that provide a supplemental supply for flood and furrow irrigation, 30 percent of the amount pumped is presumed to be the depletion to the stream. Rule 4.2(a). For wells that are the sole source of supply for flood and furrow irrigation, the percentage is 50. Rule 4.2(b). And for wells that are the sole source of supply for sprinkler irrigation systems, the presumptive stream depletion is 75 percent of the amount pumped. Rule 4.2(c). Colorado tested some different percentages. For example, 40 percent instead of 30 percent for supplemental wells was tried in the H-I model. However, Mr. Simpson testified that 30 percent was selected because it "worked," that is, the model

showed that this figure protected against depletions of usable Stateline flow. RT 147 at 41-42. Kansas' expert did not contest the 30 and 75 percent figures, but thought the 50 percent figure for sole source wells was low. RT Vol. 166 at 131. The presumptive stream depletions are to be reviewed annually, and revised if necessary to prevent material injury to senior surface rights in Colorado, and depletions to usable Stateline flows. Rule 4.3.

Implementation of the Rules begins with an estimate of pumping for the following year prepared by and within each augmentation association. Using the presumptive stream depletions, the amount of required replacement water can be calculated. RT Vol. 164 at 136. An augmentation plan for replacement water is then prepared and submitted to the State Engineer for approval. Rule 6. Unit response factors are developed by the State Engineer to determine the timing and location of stream depletions. Rule 8. A separate accounting model also utilizes monthly pumping data and power consumption data obtained electronically from the electric utilities to compute monthly diversions of groundwater. Using the unit response factors, the accounting model provides the State and the augmentation associations with the amount and location of stream depletions on a monthly basis. Colo. Exh. 1018 at 27-28. These data will allow the State Engineer's office to determine whether adequate replacement water has been provided. *Id.* The H-I model will then be used in an "after-the-fact mode" to determine how well the state did in fact perform. RT Vol. 147 at 49.

In Mr. Simpson's judgment, Colorado will be in compliance with the compact in 1996. "There should be no

depletions to usable state line flow in 1996." RT Vol. 160 at 172, 174.[17]

A. Replacement Plans.

A summary of 16 replacement plans approved as of September 24, 1996 can be found in Colorado Exhibit 1058. More detailed descriptions of the plans, and their approvals by the Colorado State Engineer, appear in Colorado Exhibit 1051, Appendix C. The plans give the number of wells that are subject to the Use Rules; estimated total pumping; the out-of-priority depletions to senior surface water rights in Colorado that must be replaced; the additional amounts required to be delivered to the Stateline in order to replace depletions to usable Stateline flows; the specific sources of replacement water; and any conditions imposed by the State Engineer. The plans were forwarded to Kansas as they were submitted, beginning in early May of 1996. RT Vol. 166 at 107.

A total of 1598 active wells are included in the plans. Colo. Exh. 1058. Estimated pumping for 1996 totals 161,109 acre-feet. *Id.*[18] The amount of replacement water

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[17] Even though only 60 percent of out-of-priority depletions in Colorado had to be replaced in the first partial year of operation, Mr. Simpson thought that actual pumping would be less than the amounts estimated in the replacement plans. Moreover, there were high deliveries of transmountain water, leaving about 8,000 acre-feet of unallocated return flows. These factors provided a "cushion" during the first year of implementation. RT Vol. 160 at 171-72.

[18] Kansas evidence put the total at 165,000 acre-feet. Kan. Exh. 808 at 9. Pumping during 1975-94 averaged 175,315 acre-

required for senior Colorado ditches is 17,160 acre-feet, and 7953 acre-feet of additional replacement water is required at the Stateline. *Id.* For 1966 only, the Use Rules provide that only 60 percent of the out-of-priority depletions to senior surface water rights in Colorado must be made up. After April 1, 1997 full replacement is required. Colo. Exh. 1018, Appendix C, Rule 11. Kansas expert Dale Book estimated that meeting the full requirements for both Colorado and Kansas users will require between 40,000 and 50,000 acre-feet annually of replacement water. RT Vol. 164 at 145; RT Vol. 166 at 120. This estimate assumes a continuation of the same general level of pumping. Kansas expressed some concern about the availability of replacement water in dry years and on a long-term basis, although there was no dispute over current availability. RT Vol. 166 at 127-28; Kan Exh. 808 at 6. However, if replacement water were not to be available in sufficient quantities, the Use Rules are unequivocal that pumping must be curtailed.

Because only 60 percent of the depletions to senior surface water rights in Colorado were required to be replaced in 1966, additional replacement water was required for compact compliance at the Stateline. In determining the amounts of this additional replacement, Colorado used a factor of 10 percent of the unreplaced pumping upstream of John Martin Reservoir and 10.75 percent below. RT Vol. 166 at 111. That is, along with the replacement water required for Colorado users, the extra percentage of replacement water was intended to bring

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feet per year, although the average was only 154,995 for 1991-94. Kan. Exh. 808, Table 2.

Stateline flows into compact compliance. RT Vol. 166 at 113. The factors of 10 percent and 10.75 percent were derived from the 1992 version of the H-I model. RT Vol. 166 at 114. This was the version then available to the Colorado State Engineer, and is the version that had been recently used to determine the stipulated depletions for 1950-85. RT Vol. 162 at 68; RT Vol. 167 at 118. Nonetheless, Kansas experts testified that the 10 percent factors underestimate Stateline depletions on a long-term basis. Kan. Exh. 808 at 12. Using the Kansas June 1996 version of the H-I model, which includes current pumping for 1980-94, the 10 percent value would be 12.2 percent, and the 10.75 value would be 17.9 percent. RT Vol. 166 at 134; Kan. Exh. 804. If my recommendations in Sections V, VI and VIII concerning the H-I model are approved, the 10 percent factors used by Colorado will apparently require modification in the future in order to assure compact compliance.

B. The LAWMA Replacement Plan.

The Lower Arkansas Water Management Association ("LAWMA") is the largest of the well owner groups. The LAWMA replacement plan covers the entire area downstream from John Martin Reservoir to the Stateline (about 58 miles), and includes some 637 wells. Kan. Exh. 808 at 15. Its pumping estimate of 92,689 acre-feet is about twice the amount of the next largest plan. Kan. Exh. 808, Table 1; RT Vol. 167 at 9. The LAWMA pumping estimate was based on the 1991-95 annual average of wells included in the plan. Kan. Exh. 826 at 1.

In the reach of the stream upstream from John Martin Reservoir, the amounts of replacement water required to offset depletions to senior surface water rights in Colorado also provide substantial benefit at the Stateline. Indeed, Kansas' expert Book acknowledged that the Use Rules for upstream wells, considering only those wells, will probably "prevent depletions to usable state line flow." RT Vol. 167 at 76. However, downstream of John Martin Reservoir, the LAWMA wells are assumed to have no obligation to Colorado surface rights during the wintertime; hence, the LAWMA plan does not replace winter depletions. RT Vol. 164 at 139. Moreover, a significant amount of pumping occurs downstream of the headgate on the Buffalo Canal which does not affect any Colorado surface rights. *Id.*; Kan. Exh. 826 at 3. The Colorado State Engineer has always recognized that "some special additional requirements" would be needed in the area below John Martin Reservoir. RT Vol. 146 at 63. Nonetheless, the amount of replacement water under the LAWMA plan is only 13 percent of total postcompact pumping. Kan. Exh. 808, Table 1; RT Vol. 166 at 116. In contrast, the amounts of replacement water provided under the two large upstream plans (CWPDA and AGUA) equal 21 and 28 percent, respectively, of their postcompact pumping. *Id.* The pumping below the Buffalo Canal headgate, which is the area most likely to affect Kansas directly, was estimated at 39,598 acre-feet. Kan. Exh. 826, Attachment 5. Depletions from this amount of pumping were calculated by Kansas at 12,707 acre-feet, or about 30 percent of such

unreplaced pumping. RT Vol. 167 at 154-56. This 30 percent figure is comparable to the 10.75 percent presumptive depletion figure that Colorado used downstream of John Martin Reservoir. *Id.* at 156.

Kansas was also concerned that the LAWMA plan did not include an annual maximum amount of pumping, and allowed any replacement (figured on the basis of the average pumping during 1991-95) to be made up in the following five years. RT Vol. 167 at 10-11; Kan. Exh. 826 at 15. This degree of latitude was not allowed in any of the other replacement plans, and I expect will not be found in LAWMA's next plan which must be submitted for the year beginning March 1997. RT Vol. 167 at 14.

C. Real Time Compliance.

The Arkansas River Compact provides that Stateline flows shall not be materially depleted in either usable quantity or "availability for use." Article IV-D. Based upon this provision, Kansas introduced much evidence on the timing of replacement flows. Kansas experts spoke of "real time" compliance, which to them generally meant compliance on a monthly basis. Kan. Exh. 809 at 8-9; RT Vol. 163 at 102; RT Vol. 167 at 66. That is, Kansas wanted a reasonable amount of replacement each month rather than "slugging the water to Kansas in a couple of months early or late." RT Vol. 167 at 117. Colorado actually began releasing replacement water to the river in April 1996. RT Vol. 167 at 82. Apparently there was little or no coordination between the states on this first delivery, but on subsequent releases Kansas did acknowledge "notice" and "communication." *Id.* Still Kansas was of the view

that deliveries were made when they were most convenient and efficient for Colorado but not necessarily for Kansas. Kan. Exh. 808 at 5.

It was apparent, however, that even if depletions were made up on a monthly basis, the additional water would not be assured of matching the need in Kansas. Mr. Franzoy testified extensively about the timing of water applications on crop yields. Kan. Exh. 810; RT Vol. 164 at 93. The timely need for irrigation water, and its optimum use, varies widely with the type of crop, its stage of growth, the type of soil, and the climatic conditions. However, there is generally a "window" of 4-6 days, allowing 2-3 days on either side of the optimum time, in which irrigation water should be applied. Kan. Exh. 810 at 1, 3. Timing is critical at each stage of crop development during the growing season. Shortages at one point in the crop growth cycle generally cannot be offset by large deliveries later without significant yield reduction. *Id.* at 3; RT Vol. 164 at 105. The farmers are the people "who best know when water is needed for their crops." RT Vol. 164 at 107. And Mr. Franzoy concluded that it would be a "big benefit" if there were a system in place where replacement water would be delivered on their call. *Id.*

Actually, the notion of establishing an account in John Martin Reservoir for replacement water that would be under the control of Kansas was discussed throughout this segment of the trial. Such an account was favored by both states, but the issues were more complex than might initially appear, and no agreement could be reached during these trial proceedings. Fortunately, action by the

Arkansas River Compact Administration, and a stipulation between the states reached on March 17, 1997, avoided the issue of whether such an account could, or should, be ordered.

The Offset Account in John Martin Reservoir was established by a Resolution of the Arkansas River Compact Administration (Jt. Exh. 180) and by Stipulation of the states, approved by me on April 3, 1997. Both of these documents are included as Exhibit 9 in the Appendix. The Offset Account was also approved by the Chief of Engineers of the Corps of Engineers. The Account allows Colorado to deliver replacement water into John Martin Reservoir for the purpose of offsetting depletions to usable Stateline flows; to receive credit (less transit losses) for delivery of such water at the Stateline; and for the water to be released at the demand of Kansas. While the actual operation of the Stipulation needs to be monitored, it appears that the issue of the timing of replacement water deliveries has been resolved for the present. Some caution needs to be noted since the Offset Account can be cancelled annually by either state.

D. Conclusion.

The key to compact compliance rests not so much with the Use Rules themselves as with the Replacement Plans and their implementation. 1996 was a phase-in year since the Rules were not effective until June 1, 1996, after approval by the Colorado Water Court. The data to assess the operation of the Plans during 1996 will not be available until the spring of 1997, and will then be the subject of a future trial segment during this remedies phase. The

Replacement Plans prepared and approved for 1997 will undoubtedly reflect the experience gained in the 1996 partial year, and will provide the first complete year to examine for compact compliance.

SECTION XII

THE FORM OF REMEDY FOR VIOLATION OF THE COMPACT

In *Texas v. New Mexico*, 482 U.S. 124, 96 L.Ed.2d 105, 107 S.Ct. 2279 (1987), the Court ruled that the interstate compact on the Pecos River did not prevent ordering a suitable remedy, "whether in water or money." 482 U.S. at 130. The Special Master in that case had believed himself to be constrained by the terms of the compact, and therefore had recommended that a shortfall of 340,100 acre-feet be made up over ten years by additional water deliveries, rather than by awarding monetary damages. The Court found, however, that the lack of a specific compact provision for a remedy in case of breach did not "mandate repayment in water and preclude damages." 482 U.S. at 130.

The Arkansas River Compact is similar to the Pecos River Compact involved in *Texas v. New Mexico* in that neither compact deals with remedies for a breach. I conclude, therefore, that *Texas v. New Mexico* is controlling here, and that a suitable remedy may be in terms of money damages or in water. Evidence on this issue has not yet been taken but will be required. Making up depletions by delivering more water has "all the earmarks of specific performance, an equitable remedy that requires some attention to the relative benefits and burdens that the parties may enjoy or suffer." *Texas v. New Mexico*, 482 U.S. at 131. Likewise, a remedy in money, rather than water, requires a showing that it would be "equitable or feasible." *Id.*

Pursuant to an earlier order, Kansas has filed a statement that it seeks a remedy for past violations of the Arkansas River Compact "in the form of money only." Kan. Brief re Statement of Position at 1. Colorado, on the other hand, takes the position that repayment of past depletions in water rather than money "would likely be a more equitable remedy in this case." Colo. Response at 2. The Court in *Texas v. New Mexico* remanded the case to the Special Master for his recommendation as to whether New Mexico "should be allowed to elect a monetary remedy and, if so, to suggest the size of the payment . . . " 482 U.S. at 132. Kansas puts emphasis on the word "elect" to argue that Colorado has the burden to overcome Kansas' choice; that is, that Colorado must convince the Court that it would be equitable and feasible "to reject the remedy elected by the plaintiff state."[19] Kan. Brief re Statement of Position at 2. Kansas also cites *Barrow Development Co. v. Fulton Insurance Co.*, 418 F.2d 316 (9th Cir. 1969) for the common law rule that the election of the remedy is the prerogative of the plaintiff. I disagree with Kansas' position.

In *Texas v. New Mexico*, monetary damages had been taken off the table by the Special Master's conclusion that such a remedy was not available. This view was of no consequence to the plaintiff, Texas, because it had always sought repayment in water, not money. I read the Court's decision as merely allowing the defendant New Mexico to

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[19] In its Reply Brief, Kansas seems to soften its position, stating that the essential question is whether the Court "should" reject the request of a plaintiff state for monetary damages in a compact enforcement case. Kan. Reply Brief at 4.

be heard on its choice, once an alternative remedy became possible. When considering Kansas' argument, it also should be noted that the election did not go to the plaintiff state, which Kansas contends should be the rule, but rather to the defendant state, New Mexico.

Nor does the *Barrow* case support Kansas. The election of remedies referred to in that case involved a choice between contract or tort in filing the original complaint. It had nothing to do with the form of relief if the plaintiff were to prevail – which presumably would have been money damages under either cause of action. The question addressed in the case was whether the plaintiff, having started in contract, could switch its action to one in tort, or whether it was bound by its initial election.

Briefs have been filed on three other issues affecting damages, and these questions are discussed in the next sections of this Report.

SECTION XIII

THE MEASURE OF DAMAGES – COLORADO GAIN OR KANSAS LOSS

In the event that the remedy for past depletions of usable Stateline flow should be in the form of monetary damages, Kansas contends that the measure of the remedy "should be the greater of Colorado's gains or Kansas' losses." Kan. Brief re Statement of Position at 23. Moreover, Kansas states that Colorado's benefits from violating the compact "are expected to be higher than Kansas' injury," and, if so, the amount of the recovery should correspond to the gains in Colorado resulting from the use of Kansas' entitlement. *Id.* at 4. There is no direct Supreme Court precedent on the measure of damages in a case such as this.

While this issue has been presented on briefs, earlier evidence in the trial outlines generally the kind of benefits that have accrued to Colorado farmers from increased use of groundwater. Much of the uncertainty and insecurity associated with surface flows were eliminated. Water became available when needed to improve crop yields. Total water supplies were increased for typically water-short ditches. Some high value specialty crops became possible. In short, overall farm productivity increased, but at the cost of depletions at the Stateline. The Kansas argument begins by characterizing these benefits as "ill-gotten gains," or "illegal profit," and relies on cases that do use these terms and order the divestment of the "benefits of unlawful activity." Kan. Brief re Statement of Position at 5, 8, 9. Kansas argues further that all such benefits or gains should be eliminated in order to

minimize the incentives that a state might otherwise have to violate an interstate compact or, at least, to neglect to comply therewith. *Id.* at 5, 6-7.

At the outset, I believe that Kansas' characterization of the increased use of groundwater in Colorado is unduly harsh. Most of the postcompact wells in Colorado were lawfully drilled at a time when wells were unregulated. When Kansas filed this case, there were approximately 2062 large irrigation wells, of which 1842 were in existence before 1965. Colo. Exh. 165*, Table A-1. As the Colorado Supreme Court noted in one of its decisions, there had been "virtually no regulation of wells" prior to the adoption of the 1973 Rules. Colo. Exh. 387 at 296. However, if Colorado was slow in coming to grips with well development, so was Kansas. In Kansas, about 416 wells were in existence in 1949 in the three-county area from the Stateline to Garden City. Colo. Exh. 257*. This number had increased to 1999 by 1985. *Id.*; RT Vol. 86 at 109-111. For the period 1968-85, pumping within the several canal company service areas in Kansas averaged about 79,400 acre-feet annually. It reached a high of 149,800 acre-feet in 1981. Kan. Exh. 327 at 9, Table 10A. Kansas did not begin to regulate well through the issuance of permits until 1978. RT Vol. 28 at 6; RT Vol. 37 at 27, 32.

In both states, sophisticated systems for the establishment and regulation of surface water rights had long been in place. However, before the development of the vertical turbine pump and the availability of inexpensive electrical power, there had been little regulatory need to be concerned about groundwater pumping. The "big surge" in well development along the Arkansas River

came in the 1950s and early 1960s when there was no governmental system in either Colorado or Kansas to regulate well drilling and pumping. RT Vol. 76 at 102.

Although by the 1970s the extent of pumping in Colorado was a matter of common knowledge, that is not to say, as I concluded in my earlier report, "that the impact of such pumping on usable Stateline flows was generally known or understood." Report of Special Master at 169. Wells *per se* do not violate the compact. Only if they cause a material depletion in usable Stateline flows are they wrongful. Determining what flows are usable, and the depletions of usable flow in contrast to depletions of total flow, is a complex matter. And as the Supreme Court noted in its earlier Opinion, isolating the impacts of wells on usable Stateline flow was rendered all the more difficult because of other changing conditions during the 1970s and 1980s. The 1970s were generally dry years, and some reduction in flow would have occurred apart from pumping. Pueblo Dam came on line in 1976 and began to reregulate native flows. Transmountain imports were also increased during this period, which to some extent provided an offset to pumping. The Winter Water Storage Program was instituted. Finally, there was no quantitative or specific entitlement against which depletions to usable flow could be judged. *Kansas v. Colorado*, 514 U.S. 675, 131 L.Ed.2d 759, 775, 115 S.Ct. 1733 (1995).

This is not a case in which Colorado deliberately set out to reap the benefits of a wilful failure to perform its obligations under the compact. Had its actions been intentionally illegal, or as wilful and knowing as the factual situations in the cases on which Kansas relies,

there might have been more validity to Colorado's defense of laches.

Both states recognize that an interstate compact is both a contract and a law of the United States. *Petty v. Tennessee-Missouri Ridge Commission*, 359 U.S. 275, 285, 3 L.Ed.2d 804, 79 S.Ct. 785 (1959); *Texas v. New Mexico*, 462 U.S. 554, 564, 77 L.Ed.2d 1, 103 S.Ct. 2558 (1983). Thus, treating Colorado's violations of the compact as a violation of federal law, Kansas cites a number of cases upholding the equitable jurisdiction of the courts to order the disgorgement of profits illegally acquired. The leading case is *Porter v. Warner Holding Co.*, 328 U.S. 395, 90 L.Ed. 1332, 66 S.Ct. 1086 (1946). That suit, brought by the Price Administration under the Emergency Price Control Act of 1942, sought restitution of rents collected in excess of required rent ceilings. The District Court enjoined future excess charges, but held that it lacked jurisdiction to order restitution. The Supreme Court found, however, that the absence of specific authority in the statute did not limit the broad equitable powers of a court to secure complete justice, and to compel the defendant to "disgorge profits." 328 U.S. at 398-99. Restitution of the excessive rent charges gave effect to "the policy of Congress," and the case was remanded so the court could "exercise the discretion that belongs to it." 328 U.S. 395 at 400, 403.

The same issue of whether a court's equitable jurisdiction was limited by the remedies authorized by the statute arose in *Mitchell v. Robert De Mario Jewelry*, 361 U.S. 288, 4 L.Ed.2d 323, 80 S.Ct. 332 (1960). In that case, several employees had sought the aid of the Secretary of Labor under the Fair Labor Standards Act to recover

wages allegedly unpaid. Ultimately, the employer retaliated by discharging the employees, and the Secretary brought suit to require reinstatement and to recover the payment of lost wages. While the statute did not specifically provide for the recovery of lost wages, the Supreme Court found that a court of equity had inherent jurisdiction to give effect to the policy of the legislature, and that the statute should not be lightly interpreted to deprive the courts of this power.

These two Supreme Court decisions are frequently cited in enforcement actions of other federal statutes, supporting the equitable power of courts to order disgorgement as a remedy "for the purpose of depriving the wrongdoer of his ill-gotten gains and deterring violations of the law." *Commodity Futures Trading Commission v. American Metals Exchange Corp.*, 991 F.2d 71 (3rd Cir. 1993). See *CFTC v. Hunt*, 591 F.2d 1211 (2nd Cir. 1979) involving the Commodity Exchange Act; *SEC v. Patel*, 61 F.3d 137 (7th Cir. 1995) involving deliberate fraud against the FDA, a 27-month term of imprisonment, and violations of the Securities Exchange Act; and *Interstate Commerce Commission v. B & T Transportation Co.*, 613 F.2d 1182 (1st Cir. 1980) involving an action under the Motor Carrier Act to enjoin the collection of charges not reflected in filed tariffs, and for restitution of the overcharges.

In these cases, we find the courts exercising equitable jurisdiction to recover excess charges, to disgorge illegal profits gained from insider trading information, and to require payment of lost wages. Each case represents an aspect of the court's broad equitable powers. At the same time, however, it is recognized that the *exercise* of such jurisdiction remains a matter of discretion:

> "The inherent equitable jurisdiction which is thus called into play clearly authorizes a court, *in its discretion*, to decree restitution of excessive charges in order to give effect to the policy of Congress." *Porter v. Warner Holding Co., supra*, 328 U.S. at 400, emphasis added.

In the context of the present case, it is my view that the quantification of damages proposed by Kansas reaches too far, and if money is to be part of the remedy, that the Court's discretion should be exercised to limit the measure of damages to the losses suffered by Kansas. As I indicated in my first Report:

> "I do not believe that Colorado officials thought they were sanctioning a compact violation in the well regulations that were established, or in their failure to adopt specific regulations to protect usable Stateline flows, or in the issuance of new well permits." Report at 169.

The lack of wilfulness behind Colorado's violation of the Compact serves to distinguish the cases cited by Kansas in support of its proposed measure of damages.

Moreover, while Kansas should be made whole with respect to past violations of the compact, it is also appropriate that the remedy not result in a windfall. If it is true that differences in soils, climate, crop values, economic multipliers or other factors may result in a higher value for Arkansas River water used in Colorado than in Kansas, reliance upon those factors to quantify damages could result in a windfall recovery. This issue surfaced in *Texas v. New Mexico* before the damages were settled by stipulation. New Mexico cited two reports prepared by Texas' economist. These reports apparently estimated that

Texas' losses from past underdeliveries were approximately 50 million dollars. On the other hand, the reports indicated that New Mexico obtained an economic benefit from the use of that water in excess of one billion dollars. While New Mexico stated that these values were grossly exaggerated, it did not dispute "the qualitative fact that New Mexico's economic benefit from not delivering a quantity of water at the state line (or her economic loss from having to deliver it) greatly exceeds the economic benefit that Texas could gain from using the same quantity of water." New Mexico's Pre-hearing Brief at 15, fn. 10. The issue of a possible windfall was not settled in *Texas v. New Mexico*. However, it does not seem appropriate that Kansas' recovery in money should exceed what would have occurred had there been no violation of the compact.

Kansas argues that quantifying damages in terms of Colorado's gain is neither a windfall nor a penalty, but rather minimizes the incentive that a state would otherwise have to evade the obligations imposed by an interstate compact. This argument was also touched upon in *Texas v. New Mexico* where the court stated:

> "It might also be said that awarding only a sum of money would permit New Mexico to ignore its obligation to deliver water as long as it is willing to suffer the financial penalty. But in light of the authority to order remedying shortfalls to be made up in kind, with whatever additional sanction might be thought necessary for deliberate failure to perform, that concern is not substantial in our view." 482 U.S. at 132.

I do not see the measure of damages suggested by Kansas as being an effective deterrent to compact violations. Interstate water cases are simply too complex to be guided by the potential form of remedy. And I have no doubt about the power of equity to provide complete relief, perhaps even looking to upstream gain under appropriate circumstances.

While an interstate compact approved by Congress becomes a law of the United States, still a "Compact is, after all, a contract." *Petty v. Tennessee-Missouri Bridge Commission*, 359 U.S. 275, 285, 3 L.Ed.2d 804, 79 S.Ct. 785 (1959); *Texas v. New Mexico*, 482 U.S. 124 at 128, 96 L.Ed.2d 105, 107 S.Ct. 2279 (1987). Ordinarily, contract damages are based upon the injured party's "expectation interest," as measured by:

(a) The loss in the value to the injured party of the other party's performance caused by its failure or deficiency, plus

(b) Any other loss, including incidental or consequential loss, caused by the breach, less

(c) Any cost or other loss that the injured party has avoided by not having to perform.

Restatement (Second) of Contracts § 347 & comment (1979). In the alternative, damages may be awarded based upon the injured party's reliance interest. *Id.* at Section 349. Thus, under general principles of contract law, money damages would not be based upon Colorado's benefit, but rather on Kansas' loss. Kansas cites some specific performance and trust cases, but those precedents are not applicable to these facts.

It should be remembered, however, that this is not merely an action at law for breach of contract. It is a case between two states brought under the original jurisdiction of the United States Supreme Court. The court's jurisdiction in such cases is "basically equitable in nature." *Ohio v. Kentucky*, 410 U.S. 641, 648, 35 L.Ed.2d 560, 93 S.Ct. 1178 (1973). Yet the court's power is not restricted by traditional equity rules. As I wrote in my earlier opinion:

> "It would be a mistake, however, to decide the issue solely on the basis of conventional equity rules. In establishing the Supreme Court's original jurisdiction over litigation between states, the constitution does not speak of 'cases in law or equity,' as it does in certain other situations. Rather it refers simply to 'controversies' between states. Commentary on the difference between cases and controversies has been inconsistent and inconclusive (see 36 CJS 20 [Federal Courts § 1]; 1A CJS 302, 315, 316 [Actions §§ 1, 5c, 6]), but the constitutional language does suggest that the interstate jurisdiction is not necessarily locked into rules of either common law or equity. And in exercising this 'unprecedented' grant of judicial power (Charles Warren, 'The Supreme Court and Sovereign States,' [Stafford Little Lectures for 1924], Princeton Univ. Press, p. 32), the Court has treated it as sui generis – a substitute for the treaty and war powers which the states surrendered when the constitution was established. *Rhode Island v. Massachusetts*, 37 U.S. (12 Pet.) 657, 725, 9 L.Ed. 1233, 1260 (1838); *Kansas v. Colorado*, 185 U.S. 125, 140, 46 L.Ed. 838, 844, 22 S.Ct. 552 (1902); *North Dakota v. Minnesota*, 263 U.S. 365, 372-73, 68 L.Ed. 342, 345, 44 S.Ct. 138

(1923); *Idaho v. Oregon*, 462 U.S. 1017, 1031, note 1, 77 L.Ed.2d 387, 400, 103 S.Ct. 2817 (1983).

> As Chief Justice Taney explained in 1855, traditional chancery practice is an 'analogy' in these cases but is not controlling. *Florida v. Georgia*, 58 U.S. (17 How.) 478, 492, 15 L.Ed. 181, 189 (1855). Thus viewed, the inquiry really is one of fundamental justice rather than what is the historical or even the current practice of courts exercising less extraordinary powers. It is in this sense that the Court has observed that proceedings under its original jurisdiction are 'basically' equitable in nature. *Ohio v. Kentucky, supra*, 410 U.S. at 648, 35 L.Ed.2d at 567, 93 S.Ct. 1178 (1973)." Report at 150-51.

Most recently, the Court has indicated that the remedy in a compact case, which I deem to include the measure of damages, should provide a "fair and equitable solution that is consistent with the Compact terms." *Texas v. New Mexico*, 482 U.S. 124, 134 (1987).

A. Conclusion.

I conclude, therefore, that if a suitable remedy in this case should include money damages, those damages should be based upon Kansas' loss rather than any gain to Colorado, subject to the overriding consideration that the remedy provide a fair and equitable solution.

SECTION XIV

THE ELEVENTH AMENDMENT

A. Introduction.

If money damages are to be awarded, Colorado contends that the 11th Amendment to the United States Constitution precludes any recovery based on losses sustained by individual water users in Kansas. That Amendment provides:

> "The judicial power of the United States shall not be construed to extend to any suit in law or equity, commenced or prosecuted against one of the United States by Citizens of another State, or by Citizens or Subjects of any Foreign State."

The Amendment was adopted in 1797 out of concern that the federal courts would otherwise entertain private suits against states without regard to the sovereign immunity which they had enjoyed before ratification of the constitution. *Chisholm v. Georgia*, 2 U.S. [2 Dall.] 419, 1 L.Ed. 440 (1972). Apparently the failure to raise the issue at the constitutional convention had been something of an oversight, and there was general support for liberating the states from the prospect of adverse federal litigation, especially litigation by British creditors.

In our own time, renewed political interest in states' rights has prompted a resurgence of 11th Amendment discussion, and the Court has reviewed the origins and history of the amendment at some length. See, for example, the several opinions in *Seminole Tribe of Florida v. Florida*, 517 U.S. ___, 134 L.Ed.2d 252, 116 S.Ct. 114 (1996). The majority there held that Congress did not have the power under the Indian Commerce Clause to abrogate a

state's sovereign immunity. Even more recently, the Court has considered the scope of the *Ex parte Young* doctrine which allows suits under appropriate circumstances to proceed against state officers for injunctive relief based on alleged violations of federal law. *Idaho v. Coeur d'Alene Tribe of Idaho*, 1997 U.S. Lexis 4030. However, such a suit cannot be the functional equivalent of a suit against the state so as to render its 11th Amendment protection meaningless.

At the outset two distinctions need to be made:

(1) Unlike many 11th Amendment cases, ours does not involve the issue of jurisdiction itself. The Court has already taken jurisdiction, and in fact has determined the liability questions associated with the dispute. The questions which now implicate the 11th Amendment have to do with remedy – the extent to which the Court may look to losses sustained by farmers in Kansas when fashioning an award to the State of Kansas.

(2) In the final paragraph of its briefing on this subject (pages 40-41), Colorado refers to two types of damages which apparently it recognizes as proper under the 11th Amendment: damages based on injury to Kansas' own proprietary rights, and damages based on Kansas' role as a "quasi-sovereign."[20] Kansas has not yet

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[20] "Finally, if repayment is in money, it must be limited to damages on Kansas' proprietary and quasi-sovereign interests. The Eleventh Amendment precludes an award based on the economic injuries of individual Kansas water users." Colo. Reply Brief at 40-41. Colorado also states that it does not dispute that injury to the Kansas general economy and loss of governmental revenue would be appropriate to consider. Colo. Reply Brief at 26.

pointed to proprietary losses of its own, and therefor our inquiry into the 11th Amendment at this poin becomes a question of whether injuries to Kansas citizen are embraced within the concept of quasi-sovereignty, o whether there is any other basis for including the losse to Kansas water users in determining Kansas' damages.[21]

During oral argument on a draft of this Second Report, counsel for Colorado responded that damages to Kansas' proprietary rights might include reduction in the State's groundwater supplies, caused by diminished recharge from the river and increased pumping to make up for river shortages.[22] RT Vol. 169 at 58-59. Counsel also indicated that probably some losses to the general economy of Kansas could be established. *Id.* at 59. It is not clear whether these losses would be considered as injuries to proprietary or quasi-sovereign rights. Nonetheless, in determining such damages counsel acknowledged that it would be necessary to begin the analysis with losses suffered by Kansas water users as a result of the compact violations. *Id.* at 59-61. However, in his view, the 11th Amendment would preclude their inclusion in the ultimate damage figure.

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[21] Kansas takes the view that its entitlement "to a complete remedy for breach of the Compact" arises from its sovereign interest as a *party* to the Compact, and not from a *parens patriae* or quasi-sovereign interest. Kan. Reply Brief at 27, emphasis added.

[22] Counsel cautioned, however, that Colorado had not engaged an economist, and his responses to my questions on damages, and how damages should be determined, were without benefit of expert help, and should be understood with that reservation. RT Vol. 169 at 58, 60.

Although not always referred to by that name, quasi-sovereignty is of long standing in our law. It does not lend itself to a "simple or exact definition." *Alfred L. Snapp & Son v. Puerto Rico*, 458 U.S. 592, 601, 73 L.Ed.2d 995, 102 S.Ct. 3260 (1982). It refers to action by a state which is not based on its own proprietary or other rights as a sovereign, nor on private interests pursued by the state as a nominal party. Rather, it is a general interest that the state has in the well-being of its citizens, and which it is fitting that the state promote and defend in court. Colorado acknowledges that a state's quasi-sovereign and *parens patriae* interests are sufficient under a number of cases to support jurisdiction here and the issuance of injunctive relief. Colo. Reply Brief at 34. But Colorado contends that these authorities should not be read as allowing a state "to make claims on behalf of individual citizens," or to collect damages "based on injuries suffered by individual water users." *Id.* at 35, 2.

Of course, this action is no mere contrivance by Kansas to obtain damages for its water users. Rather, it is the State of Kansas that seeks damages, which it contends should be measured in part by the losses suffered by individual farmers. In *Texas v. New Mexico*, counsel argued that any such damages might go into the state's general fund, "rather than benefit those who were hurt." 482 U.S. at 132, n. 7. The Supreme Court responded:

> "But the basis on which Texas was permitted to bring this original action is that enforcement of the Compact was of such general public interest that the sovereign State was a proper plaintiff. See *Maryland v. Louisiana*, 451 U.S. 725, 735-739 (1981). It is wholly consistent with that view

> that the State should recover any damages that may be awarded, money she would be free to spend in the way it determines is in the public interest." *Texas v. New Mexico*, 482 U.S. at 132 n.7.

It is the same situation here. Any damages will go to the State of Kansas, to be spent as it decides, and not to individual water users.

It is interesting to note, however, that Colorado's proposed "water remedy" seems to run contrary to its views on the 11th Amendment. Colorado proposes to make up the historic shortfall in usable Stateline flows by delivering additional quantities of water (over and above that which may be required for current compact compliance) to present and future users of Arkansas River water in Kansas. Such deliveries likely would be of direct benefit to Kansas farmers – as opposed to damages paid to the State of Kansas – as compensation for past violations of the compact. In short, Colorado seems to contend that the 11th Amendment bars money compensation to the state based on losses to its citizens, but does not preclude compensation in water which may be delivered directly to those citizens. However, in oral argument Colorado responded that any deliveries of water under a water remedy would be made at the Stateline to Kansas, not to its users. It argued that Kansas could require that the excess water be used, for example, to recharge a groundwater area of the state that had nothing to do with the compact or the Arkansas River. RT Vol. 169 at 70-73. To be sure this might be theoretically possible, but also highly unlikely. In all probability, make-up water delivered into the Arkansas River and measured at the Stateline would

go to the benefit of those ditch systems that were shorted by virtue of the compact violations.

B. The Shaping of the Law.

In my review of this subject, I have found it helpful to examine the cases more or less chronologically, since there has been some shaping of the underlying principles over the years.

At first the only interstate cases under the Court's original jurisdiction were boundary cases. By their very nature such disputes involve sovereignty. They involve territory, a piece of the state itself, and obviously the state has a direct governmental interest as a state. But citizens, residents and property owners in the affected area are also directly impacted. A judgment adjusting a boundary determines whose laws are to be obeyed, whose officials will levy taxes, whose judges will decide cases, and whose rules will be used to deraign titles and resolve commercial disputes. Substantial private gains and losses can result, and it is clear that private rights of the type contemplated by the amendment will at times be adjudicated by the federal judiciary.

Notwithstanding this inevitable involvement of private rights in boundary cases, the early Court refused to accept jurisdiction over strictly private disputes. Not surprisingly, a number of attempts to avoid this result were made, sometimes with the active participation of a plaintiff state. See e.g., *New Hampshire v. Louisiana*, 108 U.S. 76, 27 L.Ed. 656, 2 S.Ct. 176 (1883), where bonds of the State of Louisiana were assigned to the State of New Hampshire by one of its citizens for collection by the State. All

expenses of litigation were paid by the original private bondholder. No state funds could be expended in the proceedings, and any recovery had to be paid over by New Hampshire to the original bondholder. The Court found that the state could not "allow the use of its name in such a suit for the benefit of one of its citizens" in order to avoid the 11th Amendment. *Id.* at 661.

These efforts seem to have come to a head in 1904 with the Court's decision in *South Dakota v. North Carolina*, 192 U.S. 286, 48 L.Ed. 448, 24 S.Ct. 269 (1904). Two brothers, bankers and brokers in New York City, owned a large number of railroad bonds on which the State of North Carolina had become liable. The State of South Dakota, by statute, arranged to accept a donation of ten of the bonds and then brought suit to enforce them in the United States Supreme Court under original jurisdiction. South Dakota also named as defendants two individuals as representatives of other bondholders. While no conditions were attached to the state's title to its bonds, the Court acknowledged that the gift was made under the "not unreasonable expectation" that South Dakota's action "might enure to his benefit as the owner of other like bonds." *Id.* at 310. The Court, in a 5 to 4 decision, with a strong dissent by Mr. Justice White, accepted jurisdiction and gave judgment for South Dakota – but only on the bonds which it directly owned. The separate cause of action in which South Dakota sought relief for the other bond holders on class action principles was summarily rejected by the majority. In short, none of the Justices was willing to allow private claimants to ride on the coattails of this interstate suit.

The law has now been long established that the state must be more than a nominal party if the protection of the Eleventh Amendment does not apply. *Maryland v. Louisiana*, 451 U.S. 725, 737, 68 L.Ed.2d 576, 101 S.Ct. 2114 (1981); *Alfred L. Snapp & Son v. Puerto Rico*, 458 U.S. 592, 73 L.Ed.2d 995, 102 S.Ct. 3260 (1982). In order to invoke the original jurisdiction of this Court, the state must bring the action "on its own behalf and not on behalf of particular citizens." *Hawaii v. Standard Oil Company of California*, 405 U.S. 251, 258 fn. 12, 31 L.Ed.2d 184, 92 S.Ct. 885 (1972).

Shortly thereafter, in 1907, the decision in *Kansas v. Colorado*, 206 U.S. 46, 51 L.Ed. 956, 27 S.Ct. 655 (1907) established the principle of equitable apportionment of interstate streams; Kansas was allowed to sue on behalf of its citizens claiming rights to Arkansas River water. The alleged facts demonstrated a sound basis for quasi-sovereignty, but the extent of relief available in such an apportionment remained uncertain because of the factual finding that Colorado had not deprived Kansas of its share of the river. This case and its predecessor, *Kansas v. Colorado*, 185 U.S. 125, 46 L.Ed. 838, 22 S.Ct. 552 (1902) are among the cases cited more recently by the Court as examples of states successfully representing the interests of their citizens. *Alfred L. Snapp & Son v. Puerto Rico*, 458 U.S. 592, 603, 73 L.Ed.2d 995, 102 S.Ct. 3260 (1982).

Fifteen years later, in a dispute involving the Laramie River, the Court decided another interstate stream apportionment, and this time there was a judgment ordering relief. *Wyoming v. Colorado*, 259 U.S. 419, 66 L.Ed. 999, 42 S.Ct. 552 (1922). However, on the question of the scope of relief, the decision is of limited value as a precedent since

both states follow the rule of prior appropriation, and for that reason the Court held that it would use that doctrine as the standard for dividing the river between them.

Nonetheless, of special relevance to the present issue is the way in which the Wyoming decision determined each state's share of the stream. The Court based its apportionment directly on the water rights of individual water users. Moreover, in doing so, it expressly adjudicated particular water rights which happened to be in controversy. For example, the opinion discussed at length the evidence relating to one priority date which Colorado claimed under the doctrine of relation, and it was held that the correct date was substantially later. Colorado's position throughout that litigation was that the case was one solely between two states, and that the Court could not determine private water rights. The Court, however, in effect abolished the line between the two states, recognizing an interstate priority for each appropriation.

Over the next eighteen years the Court issued three additional Laramie River decisions clarifying what it had done – clarification of particular significance to the argument presented by Colorado now. In *Wyoming v. Colorado No. 2*, 286 U.S. 494, 76 L.Ed. 1245, 52 S.Ct. 621 (1932), the Court issued an injunction enforcing one of the water rights it had recognized in the original decision – thus suggesting that in 1922 it had actually adjudicated private claims on the river. Then in *Wyoming v. Colorado No. 3*, 298 U.S. 573, 80 L.Ed. 1339, 56 S.Ct. 912 (1936), the Court emphasized the overriding importance of the total amount allowed to Colorado, but nevertheless, issued an injunction as to one specific water right which had been covered in the original decree. The result was to leave the

matters somewhat uncertain as to what the Court had undertaken to do. Finally, in *Wyoming v. Colorado No. 4*, 309 U.S. 572, 84 L.Ed. 954, 60 S.Ct. 765 (1940), the Court discussed all three of the previous cases and explained what actually had been intended.

With respect specifically to the injunction issued in the 1936 decree, the Court explained (309 U.S. at 579) that "this was manifestly upon the assumption that Colorado was otherwise using the total amount of water allocated to that State." The Court added that "it was not intended to restrict Colorado in determining the use of the water of the river, according to Colorado laws and adjudications, provided the diversions did not exceed the aggregate amount of 39,750 acre feet to which Colorado was entitled . . . " The holding was that the total share allocated to each state was the true adjudication of 1922, and each state was thereafter free to adjust individual rights within its borders in accordance with its own laws. Mr. Justice Van Devanter's painstaking evaluation of individual rights in 1922 was merely a means to an end; the individual rights served only as a *basis* for the overall apportionment of the stream between Colorado and Wyoming. In short, the Court in 1922 did exactly what Colorado now says it cannot do.

Meanwhile, in the year following *Wyoming v. Colorado No. 1*, the Court reiterated its opposition to actual adjudication of private claims in a suit between states. *North Dakota v. Minnesota*, 263 U.S. 365, 68 L.Ed. 342, 44 S.Ct. 138 (1923). This time the subject was not bonds but water damage on an interstate stream. North Dakota alleged that construction work by Minnesota upstream had caused flooding in North Dakota with resulting damage

to North Dakota itself (in the amount of $5,000) and to individual farms (in the amount of over $1 million). Ultimately the Court found that Minnesota was not responsible for the damage. However, it held that on proper facts it would issue an injunction in favor of North Dakota, but would not entertain the claims of the individual farmers even though presented by the state. Simply put, it reiterated the position taken in *South Dakota v. North Carolina*.

However, I find no inconsistency in the Wyoming and North Dakota cases. In Wyoming, individual claims were recognized as a basis for determining the state's total share of the stream. In North Dakota, individual damage claims were refused recognition because recovery was sought for the claimants themselves, who were actually financing the litigation. The Court found that each of the farm owners expected "to share in the . . . damages here sought in proportion to the amount of his loss," and that it was "inconceivable" that North Dakota would prosecute the damage phase of the case without intending to turn any recovery over to the individual farm owners. 263 U.S. at 375.

On the same day as the original Wyoming decision (and by means of a one-sentence reference to the principles of that case) the Court held that a Nebraska corporation could appropriate water of the North Fork of the Republican River in Colorado, and transport it across the state line for use in Nebraska. This was true notwithstanding Colorado's claim to ownership of, and the power to regulate, all the waters within its boundaries. *Weiland, State Engineer of Colorado, v. Pioneer Irrigation Co.*, 259 U.S. 498, 502., 66 L.Ed. 1027, 42 S.Ct. 568 (1922). There was no apportionment by the Court, but the right of

Nebraska citizens to some share of this interstate stream was declared to be constitutional.

In 1938, the Court in *Hinderlider v. La Plata River & Cherry Creek Ditch Co.*, 304 U.S. 92, 82 L.Ed. 1202, 58 S.Ct. 803 (1938), reaffirmed and expanded on the principles of the Kansas and Wyoming decisions. As its title indicates, that case was not brought under the original jurisdiction, but defendant Hinderlider was the state engineer of Colorado, and defended his regulatory action on the ground that the rotation he used in managing the river in Colorado was authorized by a compact between Colorado and New Mexico. The opinion is an important pronouncement on the law of interstate streams. To begin with, the Court ruled that equitable stream apportionment between states may be accomplished by compact as well as by judgment. In doing so, the Court noted that use of the rule of prior appropriation in the Wyoming case was due to the fact that both states followed that rule, and it did not preclude the use of a different approach in other cases, such as the rotation agreed upon in the Colorado-New Mexico compact. Most important, the Court held that even private Colorado rights which had vested before the compact were subject to the compact. Colorado's share of the stream was determined by the compact, and the total of all Colorado's rights could not exceed that share. Accordingly, the early priority date of the plaintiff's appropriation was unavailing to the extent that it conflicted with the management system agreed upon between the states.

In 1943, the Court decided the second Arkansas River case, this time involving a suit brought by the State of

Colorado to bar a group of Kansas citizens from prosecuting actions against water users in Colorado to adjudicate their respective rights to Arkansas River water. *Colorado v. Kansas*, 320 U.S. 383, 88 L.Ed. 116, 64 S.Ct. 176 (1943). Colorado sought a decree "that Kansas and her citizens be enjoined from litigating, or attempting to litigate, the relative rights of the two states *and their citizens*. . . . " 320 U.S. at 388, emphasis added. Colorado alleged that "no proper settlement of the relative rights of the States can be obtained in suits by Kansas appropriators and against Colorado appropriators." *Id.* The Court once again found, as it had in 1907, that Colorado was not taking more than its reasonable share and granted the injunction. But the Court also strongly urged the two states to seek a more permanent allocation through an interstate compact. The present Arkansas River Compact is expressly based on the decision in that case. Compact, Art. II.

In the latter half of this century there has been some development of the Court's attitude toward the coupling of private claims with those of a state suing as quasi-sovereign. Thus, in *Maryland v. Louisiana*, 451 U.S. 725, 68 L.Ed.2d 576, 101 S.Ct. 2114 (1981), a divided Court adopted a more favorable approach toward allowing a state to represent its citizens under that doctrine. There, Maryland and several other states challenged the constitutionality of Louisiana's "first-use" tax on natural gas, and also sought recovery of the taxes already paid. *Id.* at 728, 734. The complaint estimated the direct injuries to the plaintiff states at $1.5 million, and to their citizen consumers of gas at $120 million. 451 U.S. at 736, note 12. Among other things, the Court said:

> "Jurisdiction is also supported by the States' interest as parens patriae. A State is not permitted to enter a controversy as a nominal party in order to forward the claims of individual citizens. See Oklahoma ex rel. Johnson v. Cook, 304 U.S. 387, 82 L.Ed. 1416, 58 S.Ct. 954 (1938); New Hampshire v. Louisiana, 108 U.S. 76, 27 L.Ed. 656, 2 S.Ct. 176 (1883). But it may act as the representative of its citizens in original actions where the injury alleged affects the general population of a State in a substantial way. See, e.g., Missouri v. Illinois, 180 U.S. 208, 45 L.Ed. 497, 21 S.Ct. 331 (1901); Kansas v. Colorado, 185 U.S. 125, 46 L.Ed. 838, 22 S.Ct. 552 (1902); Georgia v. Tennessee Copper Co., 206 U.S. 230, 51 L.Ed. 1038, 27 S.Ct. 618, (1907)." 451 U.S. at 737.

With respect to the claim for injuries suffered by individual consumers, the Court stated:

> "As the Special Master observed, individual consumers cannot be expected to litigate the validity of the First-Use Tax given that the amounts paid by each consumer are likely to be relatively small. Moreover, because the consumers are not directly responsible to Louisiana for payment of the taxes, they of course are foreclosed from suing for a refund in Louisiana's courts. In such circumstances, exercise of our original jurisdiction is proper." 451 U.S. at 739.

C. The Compact.

One of the stated purposes of the Arkansas River Compact is to settle controversies not only between the states, but also "between citizens of one and citizens of

the other State." Compact, Art. I-A. The compact also defines the term "state" to include any person claiming rights to the Arkansas River under the authority of that state. Compact, Art. VII-A. In an interstate controversy a state has the power to represent the water claims of its people, and an interstate compact is binding upon the water users within a state. *Hinderlider v. La Plata River & Cherry Creek Ditch Co.*, 304 U.S. 92, 106, 82 L.Ed. 1202, 58 S.Ct. 803 (1938), *Wyoming v. Colorado*, 286 U.S. 494, 508-09, 76 L.Ed. 1245, 52 S.Ct. 621 (1932).

Thus, Kansas contends that under the compact a state and its citizens are treated as one. Kan. Reply Brief at 22. An injury to its people is an injury to the state. Kan. Brief re Statement of Position at 12. In the Laramie River disputes the Court observed that "the interests of the state are indissolubly linked with the rights of the appropriators" [i.e., the water use claimants in both states]. *Wyoming v. Colorado*, 259 U.S. 419, 468, 66 L.Ed. 999, 42 S.Ct. 552 (1922). And against a claim that certain individual water users were not bound by the decree because they were not parties to the suit, the Court stated:

> "In this the nature of the suit is misconceived. It was one between States, each acting as a quasi-sovereign and representative of the interests and rights of her people in a controversy with the other . . . Decisions in other cases also warrant the conclusion that the water claimants in Colorado, and those in Wyoming, were represented by their respective States and are bound by the decree." *Wyoming v. Colorado*, 286 U.S. 494, 508-09, 76 L.Ed. 1245, 52 S.Ct. 621 (1932).

Colorado voices concern that an overly broad interpretation of quasi-sovereignty could create the potential for double recovery. RT Vol. 169 at 55-56. That should not be a problem here, however. The Arkansas River Compact allows each state to represent its water users, and to bind them. If losses suffered by Kansas water users are included in any damages awarded to the State of Kansas, such a judgment should seal off any later recovery attempts by individual water users. Moreover, there is a substantial question whether Kansas water users have any forum open to them, apart from the compact. In 1943 Colorado was able to enjoin the prosecution of individual water rights litigation over the use of Arkansas River water. *Colorado v. Kansas*, 320 U.S. 383, 88 L.Ed. 116, 64 S.Ct. 176 (1943). During oral argument on the draft of this Second Report, counsel for Colorado acknowledged that his view of the Eleventh Amendment, together with the prior litigation, led to the conclusion that "Kansas water users do not have a remedy"; that there is "no way" to recover their losses. RT Vol. 169 at 56-57.

D. Conclusion.

For several reasons, I believe the Court should reject Colorado's present argument that the amount of damages to be awarded to Kansas may not take into account evidence of injuries to its water users.

First, Colorado's argument is inconsistent with the basic concept of quasi-sovereignty. When the conduct of one state toward the citizens of another state is general enough and substantial enough to call for responsive action by the second state, it is unrealistic and unfair to

say that the tribunal assigned to resolve the conflict must do so without considering the injuries suffered by those interests which are directly affected. Quasi-sovereignty (a recognized exception under the 11th Amendment) operates to avoid such a result. It throws the mantle of the state itself over the area and people involved in order to permit a general recovery for them, albeit the recovery is payable to the state itself. So long as the suit is not a subterfuge for recovery by individuals on their individual claims, quasi-sovereignty militates against rejection of any relevant evidence of injury.

Second, the key case on this subject, *Texas v. New Mexico*, 482 U.S. 124, 96 L.Ed.2d 105, 107 S.Ct. 2279 (1987), speaks broadly of providing a remedy for past breaches. The exclusion of any otherwise admissible evidence of injury would do violence to that approach. I rely on these statements by the Court:

> "We find no merit in [New Mexico's] submission that we may order only prospective relief, that is, requiring future performance of compact obligations without a remedy for past breaches. If that were the case, New Mexico's defaults could never be remedied." 482 U.S. at 128.

> "There is nothing in the nature of compacts generally or of this Compact in particular that counsels against rectifying a failure to perform in the past as well as ordering future performance called for by the Compact. By ratifying the Constitution, the States gave this Court complete judicial power to adjudicate disputes among them, Rhode Island v. Massachusetts, 12 Pet. 657, 720, 9 L.Ed. 1233 (1838), and this power includes the capacity to provide one State a

> remedy for the breach of another." 482 U.S. at 128.
>
> "[The] lack of specific provision for a remedy in case of breach does not, in our view, mandate repayment in water and preclude damages. Nor does our opinion in 462 U.S. 554, 77 L.Ed.2d 1, 103 S.Ct. 2558 (1983), necessarily foreclose such relief. There, we asserted our authority in this original action to resolve the case judicially, rather than by restructuring the administrative mechanism established by the Compact. That authority extended to devising a method by which New Mexico's obligation could be ascertained and then quantifying New Mexico's past obligation, as the Master has now done. We have now agreed with him that New Mexico has not fully performed, and we are quite sure that the Compact itself does not prevent our ordering a *suitable* remedy, whether in water or money." 482 U.S. at 130, emphasis added.
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> "The Court has recognized the propriety of money judgments against a State in an original action, and specifically in a case involving a compact. In *proper original actions, the Eleventh Amendment is no barrier, for by its terms, it applies only to suits by citizens against a State.*" 482 U.S. at 130, emphasis added.

Against the background of the evidence in *Texas v. New Mexico*, which found a shortfall to Texas farmers of 340,100 acre-feet, the Court's 11th Amendment statement is certainly persuasive, and to Kansas it is dispositive. It must be acknowledged, however, that this case dealt with the question of whether any money damages could be awarded at all, and not how they might be determined.

Third, as above noted, in the Laramie River decisions the Court has already used evidence of individual claims as the basis for an interstate apportionment of water. I see no meaningful distinction between the water right claims of the *Wyoming* cases, and looking to the entitlements of individual ditches and water users in Kansas, and the shortfalls thereto, in determining the damages of the state.

Finally, in the case at hand, the State of Kansas is the signatory to the Arkansas River Compact, and the only party that can sue to protect the Stateline flows guaranteed for use by Kansas water users. The states were urged by this Court to settle their differences by compact, which they did. If a money remedy is awarded for past compact violations, the damages should include all losses that have occurred as a result of such violations, including those suffered by individual water users, subject only to the overriding consideration that the remedy must finally be a "fair and equitable solution." *Texas v. New Mexico*, 482 U.S. 124, 134, 96 L.Ed.2d 105, 107 S.Ct. 2279 (1987). The State of Kansas would be a feeble representative if it were otherwise constrained.

The fundamental rule which I see at the heart of this entire subject is that if the Court accepts a case between states as one involving sovereignty or quasi-sovereignty, it is then regarded, in law, strictly as state litigation, and the 11th Amendment is not a factor. (See *Maryland v. Louisiana*, 451 U.S. 725, 745, 68 L.Ed.2d 576, 101 S.Ct. 2114 (1981), note 21.) To adopt the Colorado view is essentially to allow the Eleventh Amendment to limit the "complete judicial power" given this Court to adjudicate disputes among the states. *Texas v. New Mexico, supra* at 128. The

Court's original jurisdiction is a substitute for the treaty and war powers which the states surrendered when they ratified the Constitution. *Rhode Island v. Massachusetts*, 37 U.S. (12 Pet.) 657, 725, 9 L.Ed. 1233 (1838); *Kansas v. Colorado*, 185 U.S. 125, 140, 46 L.Ed. 838, 22 S.Ct. 552 (1902); *North Dakota v. Minnesota*, 263 U.S. 365, 372-73, 68 L.Ed. 342, 44 S.Ct. 138 (1923). I do not believe that the Eleventh Amendment was intended to curtail this unprecedented grant of judicial power to fully adjudicate a dispute between states over the enforcement of an interstate compact.

SECTION XV

PREJUDGMENT INTEREST

In their general briefing on remedies, the states have also addressed the issue of prejudgment interest. In view of the statement in *Texas v. New Mexico*, the entitlement to post-judgment interest on any money award is apparently not in issue.[23] 482 U.S. 124, 131 n.8, 96 L.Ed.2d 105, 107 S.Ct. 2279 (1987).

Kansas argues, however, that an award of prejudgment interest is appropriate for the purpose of providing complete compensation for the injuries it has suffered as a result of Colorado's breach of the compact, whether the form of remedy is in money or water. In Kansas' view, the remedy must be in "present value terms." Kan. Brief re Statement of Position at 15. Colorado opposes such an award on equitable grounds, namely, the existence of a good faith dispute over compact compliance, the absence

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[23] In *Texas v. New Mexico*, the Special Master found an accumulated shortfall of 340,100 acre-feet, which he recommended be made up over 10 years at 34,010 acre-feet annually, together with "water interest" for any bad faith failure to deliver. 482 U.S. at 127-28. The Court noted that in the event of a water remedy, Texas would be entitled "to some form of post judgment interest for the period during which that judgment is not satisfied." *Id.* at 132, n.8. However, the Court added: "We are unpersuaded, however, that 'water interest,' rather than money, should be awarded unless and until it proves to be necessary." *Id.* Colorado states that if repayment in water is recommended, post-judgment interest would be necessary only if the water was not delivered as ordered by the Court. Colo. Reply Brief at 27. Kansas strongly disagrees since delivery of make-up water would probably have to extend over a number of years.

of any compact provisions requiring the payment of money, and because the amount of any damages is not readily ascertainable, that is, damages are unliquidated. Colo. Reply Brief at 26-33.

In essence, Colorado argues in favor of the traditional approach to prejudgment interest which allowed – and, in some jurisdictions still allows – an award of prejudgment interest *only* on a liquidated claim or a strictly construed statute. *See, e.g., Moutsopoulos v. American Mut. Ins. Co.*, 607 F.2d 1185, 1190 (7th Cir. 1979), interpreting Wisconsin law; *Clements Auto Co. v. Service Bureau Corp.*, 444 F.2d 169, 189 (8th Cir. 1971), interpreting Minnesota law; *Tenneco Oil Co. v. Gaffney*, 369 F.2d 306 (10th Cir. 1966), applying Wyoming law.

The rationale underlying the distinction between liquidated and unliquidated damages, for the purpose of awarding prejudgment interest, is that the defendant should not have to pay interest on damages that cannot be readily ascertained before judgment. By the nature of the dispute, the defendant is unable to halt the accrual of interest by making payment. Rothschild, *Prejudgment Interest: Survey and Suggestion*, 77 Nw U.L. Rev. 192, 197; D. Dobbs, *Law of Remedies* § 3.6(3) (2nd Ed. 1993)

This rationale, however, "has faced trenchant criticism for a number of years." *City of Milwaukee v. Cement Div., National Gypsum Co.*, 515 U.S. 189, 132 L.Ed.2d 148, 156, 115 S.Ct. 2091 (1995). Moreover, courts have recognized that an award of prejudgment interest *is* appropriate in order to provide complete compensation. *General Motors Corp. v. Devex Corp.*, 461 U.S. 648, 655-656, 76 L.Ed.2d 211, 218, 103 S.Ct. 2058 (1983); *Funkhouser v. J.B.*

Preston Co., 290 U.S. 163, 168, 78 L.Ed. 243, 246, 54 S.Ct. 134 (1933); *Miller v. Robertson*, 266 U.S. 243, 257-58, 69 L.Ed. 265, 45 S.Ct. 73 (1924); *Davis Cattle Co. v. Great Western Sugar Co.*, 393 F.Supp. 1165, 1187, 1192-94 (D.Colo. 1975) (applying Colorado law), aff'd, 544 F.2d 436, 441-42 (10th Cir. 1976), cert. den., 429 U.S. 1094 (1977). Further, courts have determined that prejudgment interest may be necessary to avoid unjust enrichment of a defendant who has had the use of money or things which rightly belong to the plaintiff. *Martinez v. Continental Enterprises*, 730 P.2d (Colo. 1986). They have also recognized in some instances that, if prejudgment interest is not awarded, the defendant may have an incentive to delay payment. D. Dobbs, *Law of Remedies, supra*, § 3.6(3) and cases cited.

As a consequence, a majority of jurisdictions reject the strict, traditional approach to awarding prejudgment interest. (Rothschild, *Prejudgment Interest: Survey and Suggestion, supra*, p. 204) As early as 1933, for example, the Supreme Court stated:

> "It has been recognized that a distinction, in this respect, simply as between cases of liquidated and unliquidated damages, is not a sound one. Whether the case is of the one class or the other, the injured party has suffered a loss which may be regarded as not fully compensated if he is confined to the amount found to be recoverable as of the time of the breach and nothing is added for the delay in obtaining the award of damages. Because of this fact, the rule with respect to unliquidated damages has been in evolution, and in the absence of legislation the courts have dealt with the question of allowing

> interest according to their conception of the demands of justice and practicality." *Funkhouser v. J.B. Preston Co., supra,* 290 U.S. at 163, 168-169, 78 L.Ed. 243, 54 S.Ct. 134 (1933), citations omitted.

Although it may be only dictum, and also an admiralty case, the Court's decision in *City of Milwaukee v. Cement Division, National Gypsum Co.*, 515 U.S. 189, 132 L.Ed.2d 148, 115 S.Ct. 2091 (1995) is so recent and pointed that it must strongly influence the prejudgment interest issues. At the outset, it should be acknowledged that the case involves a maritime collision under admiralty law. The general rule in such cases has been long established that prejudgment interest should be awarded, subject only to a limited exception for "peculiar" or "exceptional" circumstances. 132 L.Ed.2d at 154. The district court in this case found such unusual circumstances. It determined that the plaintiff bore 96 percent of the responsibility for the disaster, while the City of Milwaukee bore only 4 percent of the fault, and ruled that it would have been inequitable to award prejudgment interest in light of the magnitude of plaintiff's contributory negligence. The court of appeals made its own analysis of the record and changed the apportionment of liability to two-thirds to National Gypsum and one-third to the City. It also reversed the judgment, which the Supreme Court affirmed in a unanimous decision by Justice Stevens (Justice Breyer took no part in the decision).

After appropriate apportionment, the City's one-third share of damages owed to National Gypsum was

$1.677 million, but National Gypsum also sought prejudgment interest in the sum of $5.3 million.[24] In upholding an award of prejudgment interest, the Court dismissed the City's argument of a good faith dispute over its liability as having "little weight." 132 L.Ed.2d at 155. The Court was also "unmoved" by the City's contention that an award of prejudgment interest is inequitable in a mutual fault situation. *Id.* at 157. Indeed, since liability had already been apportioned, the Court stated that a "*denial* of prejudgment interest would be unfair." *Id.* "The essential rationale for awarding prejudgment interest is to ensure that an injured party is fully compensated for its loss." *Id.* at 155.

The Court also discussed the liquidated/unliquidated damage issue, noting that the distinction had never become "so firmly entrenched in admiralty as it has been at law," and indeed has faced "trenchant criticism for a number of years." *Id.* at 156. Nearly 65 years ago the Court remarked that the rule with respect to unliquidated damages "has been in evolution." *Funkhouser v. J. B. Preston, supra,* 290 U.S. at 168-69. And while the conceptual differences have not been completely reconciled outside of the admiralty context,[25] the trend of the evolution is clear: the compensatory rationale for prejudgment

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[24] The Court did not pass on the methodology used to calculate prejudgment interest, nor upon the rate to be applied.

[25] See, for example, *Blau v. Lehman,* 368 U.S. 403, 7 L.Ed.2d 403, 82 S.Ct. 451 (1962) where prejudgment interest on unliquidated damages was denied, and *Jackson County v. United States,* 308 U.S. 343, 84 L.Ed. 313, 60 S.Ct. 285 (1939) where prejudgment interest was denied on grounds of fairness.

interest has emerged as the dominant principle. Prejudgment interest will be allowed in a majority of jurisdictions irrespective of whether the obligation underlying such interest is liquidated. Rothschild, *Prejudgment Interest: Survey and Suggestion, supra.* The Court's recent decision in *City of Milwaukee* strongly suggests that the kinds of objections to prejudgment interest raised by Colorado are now obsolete.

Kansas' claim for damages in this case certainly represents an unliquidated claim. Determining the amount of depletions to usable Stateline flow has required an extensive trial. And determining the money damages as a result of the shortfall, if that should be the remedy, has yet to be tried. However, I have concluded that the unliquidated nature of Kansas' money damages does not, in and of itself, bar an award of prejudgment interest.[26]

That is not to say, however, that Kansas is necessarily entitled to prejudgment interest on any award of money damages or remedy requiring additional water to make up the shortfall. Even in admiralty cases "such an award has never been automatic." *City of Milwaukee,* 132 L.Ed.2d at 155. Allowance of interest on damages "is not an absolute right," and whether prejudgment interest ought or ought not to be allowed rests "very much in the discretion of the tribunal which has to pass upon the

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[26] "Any fixed rule allowing prejudgment interest only on liquidated claims would be difficult if not impossible to reconcile with admiralty's traditional presumption. Yet unless we were willing to adopt such a rule – which we are not – uncertainty about the outcome of a case should not preclude an award of interest." *City of Milwaukee,* 132 L.Ed.2d at 156.

subject . . . " *Id.* Interest is not recoverable "according to a rigid theory of compensation for money withheld, but is given in response to considerations of fairness." *Jackson County v. United States*, 308 U.S. 343, 352, 84 L.Ed. 313, 60 S.Ct. 295 (1939). The Court in *City of Milwaukee* stated that it had never attempted "to exhaustively catalogue the circumstances that will justify the denial of interest," but noted that "the most obvious example" would be the plaintiff's responsibility for undue delay in prosecuting the lawsuit, citing *General Motors Corp v. Devex Corp.*, 461 U.S. 648, 657, 76 L.Ed.2d 211, 103 S.Ct. 2058 (1983). *City of Milwaukee*, 132 L.Ed.2d at 155. The Court also added: "Other circumstances may appropriately be invoked as warranted by the facts of particular cases. *Id.*

In the case at hand, depletions of usable Stateline flows in violation of the compact reach back to 1950, and Kansas seeks relief, preferably in money damages, for the total amount of the shortfall since 1950. The Court has already ruled that Kansas was not guilty of laches in bringing this action, but nonetheless Kansas did not seek to file its complaint until the end of 1985. The parties then took almost five years in preparing for trial which began in September of 1990. Whether any of the circumstances and developments that have occurred since 1950 may be considered in assessing the appropriateness of prejudgment interest should be a matter of argument and proof in future proceedings of the remedies phase of this case. Much like *Jackson County v. United States*, we are without "roots in history" in approaching the issue of damages and prejudgment interest in a case of this kind. 308 U.S. at 351, *supra.*

SECTION XVI

RECOMMENDATIONS

Following the Court's May, 1995 Decision confirming my initial Report on liability, the case was remanded for further proceedings. *Kansas v. Colorado*, 514 U.S. 675, 131 L.Ed.2d 759, 115 S.Ct. 1733 (1995). The issues on which additional evidence and briefing have now been received are: (a) quantifying the depletions in usable Stateline flow for the period 1950-85; (b) quantifying depletions for the period subsequent to 1985; (c) evaluating Colorado's efforts to comply with the compact on a current basis; and (d) considering certain legal issues with respect to a remedy for past violations of the compact. This Second Report presents my recommendations on these issues. Accordingly, I recommend:

1. That the Court approve my Order of September 19, 1995 (Appendix Exhibit 3) denying Kansas' Motion for Injunction.

2. That the Court approve the Stipulation of the states quantifying depletions to usable Stateline flow caused by postcompact pumping in Colorado for the period 1950-85 in the amount of 328,505 acre-feet. Appendix Exhibit 6.

3. That depletions of usable Stateline flow for the 1986-94 period be determined to be 91,565 acre-feet.

4. That Colorado's efforts to bring the state into current compliance with its compact obligations have been sufficient to preclude at this point in time the need for interim injunctive relief, or to require changes in Colorado's Measurement Rules or Use Rules; that such

Colorado activities continue to be closely monitored through the remaining trial proceedings of this case; that compact compliance for 1996 and subsequent years be determined; and that any depletions for 1995 also be determined.

5. That the Court approve the Stipulation of the states, dated March 17, 1997 and approved by me on April 3, 1997, which together with the Resolution of the Arkansas River Compact Administration, establishes an Offset Account in John Martin Reservoir for the storage and delivery of replacement water to Kansas to offset depletions of usable Stateline flow. Appendix Exhibit 9.

6. That evidence be received on a suitable remedy for past compact violations, whether such remedy be in water or in money.

7. That if a suitable remedy in this case should include money damages, those damages should be based upon Kansas' loss rather than upon any gain to Colorado, subject to the overriding consideration that the remedy provide a fair and equitable solution.

8. That if the remedy in this case includes money damages, the 11th Amendment does not preclude damages to the State of Kansas from being based, in part, on losses incurred by its water users, again subject to the overall consideration of fairness.

9. That the unliquidated nature of Kansas' claim for damages does not bar the award of prejudgment interest, whether the remedy includes money damages or water

repayment; that the possible award of prejudgment interest will depend upon the evidence presented in future trial proceedings.

If the Court finds in accord with my recommendations in this Second Report, or otherwise, then I recommend that the case be remanded for further evidence and conclusion of the remedy phase of the trial.

Dated: September 8, 1997

Respectfully Submitted,

ARTHUR L. LITTLEWORTH
Special Master

APPENDIX – Exhibit 1

Order re Trial Proceedings for Remedies Phase, and Reallocation of Costs, filed August 11, 1995

IN THE SUPREME COURT OF THE UNITED STATES

STATE OF KANSAS, Plaintiff, v. STATE OF COLORADO, Defendant, UNITED STATES OF AMERICA, Intervenor.	)	No. 105 Original October Term, 1985

ORDER RE TRIAL PROCEEDINGS FOR REMEDIES PHASE, AND REALLOCATION OF COSTS

(Filed Aug. 11, 1995)

The United States Supreme Court in its opinion dated May 15, 1995 affirmed my Report concerning the liability phase of the case, and remanded the matter for determination of the unresolved issues. (115 S.Ct. 1733) These issues relate to the remedies phase of the case, including damages and injunctive relief.

A status conference was held in Denver, Colorado, on July 27-28, 1995 to discuss future proceedings. As a result thereof, it is hereby ordered:

1. That trial will resume on the remedies phase of the case on October 30, 1995 at 9:30 a.m. in the United States Court of Appeals, Courtroom 3, 125 South Grand Avenue, Pasadena, California.

2. That the parties may present evidence on three subjects: revisions to Kansas' H-I Model in accordance with the recommendations in my Report, as affirmed by

the Supreme Court; Stateline depletions to usable flow caused by postcompact pumping in Colorado for the period 1950-85, as determined by the revised H-I Model; and the then current status of efforts by Colorado to comply with the Arkansas River Compact.

3. That with respect to the revisions to be made to the H-I Model and the modified depletion results, all computer information and all data to be offered in evidence or used in the preparation of exhibits, expert reports or testimony shall be exchanged among the parties by August 30, 1995; and the parties and their experts shall confer on or before September 6, 1995 in an effort to reach as much agreement thereon as possible.

4. That a report by the State Engineer of Colorado be provided to Kansas by September 29, 1995, setting forth in detail the actions being taken by and within Colorado to comply with the Arkansas River Compact, including any augmentation plans being developed or used by entities within Colorado, and any data collection and monitoring programs.

5. That the parties may take such depositions as may be required in connection with the subjects of the October 30 segment of the trial or the February 19, 1996 segment hereinafter discussed.

6. That on or before November 17, 1995 Kansas shall file a statement of its position with respect to damages, together with a brief in support thereof. The statement shall indicate whether Kansas seeks damages in terms of money, or in terms of water, or a combination thereof. Colorado shall have until January 19, 1996 in which to file its response, and Kansas shall have until

March 6, 1996 to reply. It is expected that the briefs will cover in general terms such issues as the measure of damages, that is, whether damages should be based on injury to Kansas or benefit to Colorado, or on some combination; water versus money damages; interest; and any impact of the Eleventh Amendment to the Constitution.

7. That the trial shall resume on February 19, 1996 at 9:30 a.m. in the United States Court of Appeals, Courtroom 3, 125 South Grand Avenue, Pasadena, California, to consider evidence on these additional subjects: Stateline depletions as determined by the H-I Model for the period 1986-94; Kansas' response to the Colorado compliance efforts presented during the October 30 segment of the trial, and any other evidence it may wish to present in regard to compliance; and continued testimony by Colorado on its program to comply with the Compact. This segment of the trial will also include a status conference to consider future proceedings.

8. That on or before December 21, 1995 Kansas shall provide Colorado with all computer information, data and files used in connection with the modeling of depletions for the period 1986-94, including any changes to the H-I Model and any recalibration results. The parties and their experts shall meet on or before January 10, 1996 in an effort to understand and to reach as much agreement as possible on the operation of the H-I Model for the 1986-94 period, and the data used in connection therewith.

9. That by January 10, 1996 Kansas will provide Colorado with copies of all expert reports or summaries

of expert testimony concerning the evidence which it proposes to present during the February 19 trial segment with respect to the Colorado compliance efforts, or its own views on compliance.

10. That where feasible, all expert studies, investigations, conclusions and opinions should be put into report form, together with supporting data, and made available to the opposing parties in sufficient time to permit them to prepare adequate cross-examination, rebuttal testimony and exhibits.

11. That in view of the United States' decision that, absent unforeseen circumstances, it will not take an active role in the remedies phase of the case, the United States is relieved as of July 31, 1995 of the obligation to pay 20% of all fees and costs incurred by the Special Master. At such time, if any, that the United States should resume an active role, its appropriate share of costs will be reexamined. After July 31, 1995 Special Master fees and costs shall be allocated equally between Kansas and Colorado.

12. That by October 30, 1995 Kansas and Colorado shall each advance for deposit in the interest-bearing trust account established in this case the sum of $50,000.00, to be applied against Special Master fees and costs.

DATED: August 11, 1995.

/s/ Arthur L. Littleworth
ARTHUR L. LITTLEWORTH
Special Master

PROOF OF SERVICE BY MAIL

STATE OF CALIFORNIA, COUNTY OF RIVERSIDE

I am a citizen of the United States and a resident of the County aforesaid; I am over the age of eighteen years and not a party to the within entitled action; my business address is Best, Best & Krieger, 3750 University Avenue, 400 Mission Square, Riverside, California 92502.

I am readily familiar with Best, Best & Krieger's practice for collecting and processing correspondence for mailing with the United States Postal Service. Under that practice, all correspondence is deposited with the United States Postal Service the same day it is collected and processed in the ordinary course of business.

On August 11, 1995, I served the within ORDER RE TRIAL PROCEEDINGS FOR REMEDIES PHASE, AND REALLOCATION OF COSTS by placing a copy of the document in a separate envelope for each addressee named below and addressed to each such addressee as follows:

John B. Draper, Esq.
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Donald M. Gerstein
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Cheyenne, Wyoming 82002

On August 11, 1995, at the office of Best, Best & Krieger, 3750 University Avenue, 400 Mission Square, Riverside, California 92502, I sealed and placed each envelope for collection and deposit by Best, Best & Krieger in the United States Postal Service, following ordinary business practices.

I declare under penalty of perjury under the laws of the State of California, that the foregoing is true and correct.

Executed on August 11, 1995, at Riverside, California.

/s/ Sandra L. Simmons
Sandra L. Simmons

APPENDIX – Exhibit 2

Supplemental Order re Trial Proceedings,
filed September 28, 1995

IN THE SUPREME COURT OF THE UNITED STATES

STATE OF KANSAS, Plaintiff, v. STATE OF COLORADO, Defendant, UNITED STATES OF AMERICA, Intervenor.	)	No. 105 Original October Term, 1985

SUPPLEMENTAL ORDER RE TRIAL PROCEEDINGS

(Filed Sep. 28, 1995)

By a conference call on September 19, 1995, counsel raised two questions with respect to my Order re Trial Proceedings for Remedies Phase, dated August 11, 1995. They asked whether the required H-I model pumping adjustments for declining well efficiencies and for non-electric pumping should be made for the whole 1950-85 period, or for the period 1964-85 only. Secondly, they asked whether the October 30 trial segment is to include evidence on the extent to which accretions may offset depletions. It was agreed that the parties would submit their respective positions by letters to be filed on September 25, 1995. In its letter, Colorado now agrees with Kansas that adjustments for nonelectric pumping should be made back to 1950, so that matter is no longer an issue.

With respect to the pump efficiency adjustments, Kansas maintains that my Report calls for such changes to be made over the full 1950-85 period, while Colorado

argues that only the period of 1964-85 should be considered. These adjustments are to be made on the basis of the Colorado evidence introduced in the liability phase of the trial, and that evidence covered the period from 1940 to 1985. Colo. Exh. 165*, Figure 6.2. However, Colorado reads the discussion in my Report of the testimony of Longenbaugh and Miles, and my statement that "I find that the 1964-68 power coefficients on average did decline," to mean that efficiency adjustments should be made only for the years 1964 and thereafter.

Colorado's evidence was based upon the 1964-68 data collected by the USGS and published in Basic-Data Release No. 21. Jt. Exh. 66. Colorado's experts then extrapolated backward in time from these data to estimate pump efficiencies in the prior years, going back to 1940. Report at 189. This analysis assumed that the older pumps in the 1940s were more efficient than those tested in the 1964-68 period, and hence pumped larger quantities of water for any given amount of power consumption. I questioned this approach because it did not take into account the replacement of centrifugal pumps in the 1940s and early 1950s by the much more efficient vertical turbine pumps. Report at 184-85, 189. However, the issue whether Colorado's analysis was sound for the 1940s does not apply to its pump efficiency adjustments for the period of 1950-64. There may have been some conversions to turbine pumps after 1950, but the impact of such later conversions on the present issue would have been relatively small. I conclude, therefore, that the pump efficiency modifications to the H-I model, as required in my Report, should be made for the full 1950-85 period.

Insofar as accretions are concerned, I did not have the issue in mind when the October 30 schedule was discussed. Certainly this is an issue that must be decided, but Kansas indicates that it cannot properly be prepared on the subject for the October 30 segment of the trial. Accordingly, my August 11 Order is augmented to add to the February 19 trial segment the presentation of evidence on the extent, if any, to which accretions calculated by the H-I model should be used to offset depletions of usable Stateline flows. I understand Colorado's desire to settle this issue as soon as possible, and if the states can agree upon an earlier schedule, the necessary trial days can probably be arranged. However, if no earlier date is agreed upon, the parties are ordered to complete depositions and any other discovery, and to exchange reports of any expert testimony, in sufficient time before February 19 to allow adequate preparation of their respective cases.

DATED: September 28, 1995.

/s/ Arthur L. Littleworth
ARTHUR L. LITTLEWORTH
Special Master

PROOF OF SERVICE BY MAIL

STATE OF CALIFORNIA, COUNTY OF RIVERSIDE

I am a citizen of the United States and a resident of the County aforesaid; I am over the age of eighteen years and not a party to the within entitled action; my business address is Best, Best & Krieger, 3750 University Avenue, 400 Mission Square, Riverside, California 92502.

I am readily familiar with Best, Best & Krieger's practice for collecting and processing correspondence for mailing with the United States Postal Service. Under that practice, all correspondence is deposited with the United States Postal Service the same day it is collected and processed in the ordinary course of business.

On September 28, 1995, I served the within SUPPLEMENTAL ORDER RE TRIAL PROCEEDINGS by placing a copy of the document in a separate envelope for each addressee named below and addressed to each such addressee as follows:

John B. Draper, Esq.
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Donald M. Gerstein
Assistant Attorney General
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123 Capitol Building
Cheyenne, Wyoming 82002

On September 28, 1995, at the office of Best, Best & Krieger, 3750 University Avenue, 400 Mission Square, Riverside, California 92502, I sealed and placed each envelope for collection and deposit by Best, Best & Krieger in the United States Postal Service, following ordinary business practices.

I declare under penalty of perjury under the laws of the State of California, that the foregoing is true and correct.

Executed on September 28, 1995, at Riverside, California.

/s/ Sandra L. Simmons
Sandra L. Simmons

APPENDIX – Exhibit 3

Order Denying Kansas' Motion for Injunction,
filed September 19, 1995

IN THE SUPREME COURT OF THE UNITED STATES

STATE OF KANSAS, Plaintiff, v. STATE OF COLORADO, Defendant, UNITED STATES OF AMERICA, Intervenor.	)	No. 103 Original October Term, 1985

ORDER DENYING KANSAS' MOTION FOR INJUNCTION

(Filed Sep. 19, 1995)

Prior to the commencement of trial in this case, I granted Kansas' motion to bifurcate the trial into liability and remedy phases. Order, Jan. 2, 1990. The trial proceeded on this basis, and in July of 1994 I submitted my Report to the Supreme Court on the various liability issues. I recommended that the Court find that postcompact well pumping in Colorado had violated Article IV-D of the Arkansas River Compact. I found no other compact violations by either state or by the United States.

Both states filed exceptions to the Report, with briefs in support of their positions. The exceptions were argued before the Supreme Court on March 21, 1995, and the Court's Opinion was issued on May 15, 1995. 131 L.Ed.2d 759, 115 S.Ct. 1733. The Court overruled all of the exceptions of both states, and by Order dated May 15, 1995

remanded the case to me "for determination of unresolved issues in a manner not inconsistent with the opinion of this Court." The unresolved issues include the quantification of past shortages and the remedies available, including the issues of injunctive relief and damages.

On June 13, 1995 the State of Kansas filed a Motion for Injunction and requested an expedited hearing. Counsel agreed upon a briefing schedule, and the motion was argued as part of the status conference which already had been set for July 27-28, 1995 in Denver. The purpose of the status conference was to consider future proceedings with respect to the remedies phase of the case.

The Kansas motion sought a recommendation that the Supreme Court enjoin the State of Colorado from violating the Arkansas River Compact as construed in its May 15, 1995 Opinion, specifically requesting:

> "That the State of Colorado be enjoined from pumping more than 15,000 acre-feet per compact year of the waters of the Arkansas River as defined in Article IIIB of the Arkansas River Compact until such time as, and only to the extent that, Colorado has demonstrated the adequacy and guaranteed the delivery of future offsetting stateline flows to which Kansas would not otherwise be entitled under the Compact."

The motion was based on the grounds that the Supreme Court had determined that "the pumping sought to be enjoined" violates Article IV-D of the compact; that an injunction will lie to enforce the compact as a federal statute; and that requiring "immediate compliance" with the compact is appropriate, although the

amount of past depletions still needs to be determined. An affidavit supporting the motion states that current pumping in Colorado exceeds 15,000 acre-feet annually, and is "similar" to the 1950-85 figures which ranged between 145,000 and 161,000 acre-feet annually. Moreover, the affidavit states that Colorado has not guaranteed flows to offset such pumping.

Colorado responded that the motion, in effect, is a motion for a preliminary injunction, requiring a weighing of equities between the states. Colorado argues that Kansas has not shown that it will suffer immediate and irreparable injury without the injunction, or that the threatened injury to Kansas outweighs the damage to Colorado should the injunction issue. Moreover, Colorado states that there is no accepted method by which depletions can be determined, nor by which Colorado can demonstrate the adequacy of any plan to replace them. Colorado also accompanied its written Response to the motion with an affidavit of the State Engineer outlining the actions now being taken by Colorado to bring it into compliance with the compact.

The crux of the Kansas argument is that the Supreme Court has determined that pumping in excess of 15,000 acre-feet annually violates the compact. Therein also lies the principal weakness in the Kansas position. For the Supreme Court did not find, nor did I recommend, that any pumping over 15,000 acre-feet was unlawful *per se*.

During the liability phase of the trial, both states acknowledged that some pumping in Colorado did occur during the precompact years, although the pumping amounts were hotly disputed. Kansas estimated that the

highest amount was 11,000 acre-feet in 1948. Colorado experts testified to actual precompact pumping of 36,837 acre-feet, but Colorado claimed that such precompact wells had an "entitlement" which averaged 49,275 acre-feet over the 1950-85 period. I found that 15,000 acre-feet annually was the best estimate of the pumping that was occurring when the compact was being negotiated. That use of water was part of the status quo that the states were trying to preserve. Accordingly, I found that such amount of annual pumping should be allowed under the compact. However, I rejected Colorado's entitlement theory which would have allowed the precompact pumping figure to expand.

But because 15,000 acre-feet of pumping is lawful, it does not necessarily follow that any additional pumping is in violation of the compact. Article IV-D provides that the compact is not intended to prevent water development in Colorado, including the improved or prolonged functioning of existing works, provided that the waters of the Arkansas River "shall not be materially depleted in usable quantity or availability." Stateline flows are impacted not only by Colorado's pumping but also by changes in the amount of irrigated acreage, by changes in the amount of applied water on such acreage, by changes in the diversions of surface flow, and by the importation of transmountain water and the use (or nonuse) of return flows therefrom.

For the period 1950-85, for example, the evidence showed a small decline in total irrigated acreage in Colorado, but an increase in applied water per acre. Report at 268-70. Diversions, according to Colorado's evidence,

decreased about 28,000 acre-feet annually when compared with precompact amounts, without consideration of diversions from transmountain imports. Report at 270-71. During the period of compact negotiations, transmountain imports averaged approximately 43,000 acre-feet per year (although some of this water was used to supply the cities of Aurora and Colorado Springs outside of the Arkansas River Basin) while during 1950-85 the average was estimated to have increased to between 56,210 and 60,445 acre-feet for use in the Arkansas River Valley. Report at 49. What comparable data would show since 1985 is unknown.

Experts for both states testified that the only way to isolate depletions caused by postcompact pumping, as opposed to depletions caused by other changes along the stream system, was through the use of hydrologic modeling. Both states constructed such models and introduced evidence of Stateline depletions caused by pumping alone for the period 1950-85. Report at 243-290. However, all of that evidence is now ten years old. We have no data on conditions since 1985.

Moreover, at this point in the trial past depletions have not been quantified, and we have no methodology that has yet been sanctioned to predict depletions. In my Report, I found that certain adjustments will be required in the data used in both the Kansas H-I model and the Colorado water budget model. These have yet to be accomplished, although modifications to the Kansas H-I model are the subject of the next trial segment, scheduled to begin on October 30, 1995. At the recent status conference, Colorado indicated that the required changes to its own water budget model, in contrast to those required in

the H-I model, would be expensive, time-consuming and difficult. RT Vol. 144 at 61-62. Accordingly, counsel for Colorado announced that it has basically "shelved that model" (its own water budget model), and intends in the future to work through the Kansas H-I model. RT Vol. 144 at 52.

Initially, Kansas was reluctant to accept this proposal and stated that it planned to make the required adjustments to the Colorado model on its own, and to introduce evidence of the depletions therefrom for the 1950-85 period. RT Vol. 144 at 58-59. By the next day, however, Kansas recognized that its intention to run the Colorado model would cause significant complications in the prompt scheduling of future proceedings, and Kansas stated that it had decided to forego that effort. RT Vol. 145 at 5.

It appears, therefore, that the Kansas H-I model will become the accepted tool for determining Stateline depletions caused by pumping. Evidence of the required adjustments in that model for the 1950-85 period will be presented during the October 30 trial segment. At the next segment scheduled for February 19, 1996, evidence will be presented on the Stateline depletions as determined by the H-I model for the period 1986-94.

Denial of the Kansas motion now does not preclude appropriate interim relief in the future. However, the short answer to the present Kansas motion is that at this point in time the evidence does not support the 15,000 acre-feet figure. The means are not now available for me to determine the impact of current pumping.

Kansas relies heavily on the precedent set in *Texas v. New Mexico*, 482 U.S. 124 (1987). To be sure, an injunction in that case was issued before the damage phase was completed, but that case was much farther along than we are.

Prior to the Court's 1987 Opinion in *Texas v. New Mexico*, the case had been before the Supreme Court on several earlier occasions.[1] The 1949 compact between Texas and New Mexico provides that New Mexico shall not deplete flows of the Pecos River below an amount that will provide Texas with "a quantity of water equivalent to that available to Texas under the 1947 condition." *Id.* at 126. However, the Inflow-Outflow Manual incorporated into the compact and designed to determine the 1947 condition for the future "proved to be so faulty as to be unusable." *Id.* at 129, fn. 6. A new inflow-outflow manual was later developed by the Special Master, but was not finally approved by the Court until 1984 as the "methodology to be used in calculating Texas' entitlement." *Id.* at 127. The formula had to be fashioned in the course of the litigation in view of the inability of the Pecos River Commission to agree upon how the river water should be divided.

In the 1987 Opinion relied upon by Kansas, the Supreme Court issued a decree enjoining New Mexico:

> "To comply with the Article III(a) obligation of the Pecos River Compact by delivering to Texas at state line each year an amount of water calculated in accordance with the inflow-outflow

---

[1] See 446 U.S. 540, 64 L.Ed.2d 485 (1980); 462 U.S. 554, 77 L.Ed.2d 1 (1983); 468 U.S. 1238, 82 L.Ed.2d 816 (1984).

> equation contained in Texas Exhibit 68, at page 2." *Id.* at 135.

In addition, the Court ordered New Mexico to calculate "the Index Inflow component of the inflow-outflow and channel-loss equations contained in Texas Exhibit 79, modified to reflect the Court's decision of June 8, 1987, as to manmade depletions chargeable to New Mexico." *Id.* The Court further ordered that "Index Inflow" shall mean "the 3-year progressive average of 'annual flood inflows' as those terms are defined in Texas Exhibit 79, Table 2, p.5." *Id.*

While by 1987 in *Texas v. New Mexico* the amount of the accumulated shortfall had been determined for the 1950-83 period (340,100 acre-feet of water), the shortfall between 1983 and the Court's 1987 Opinion still remained unquantified. The question of whether the remedy for past shortages should be in water or in money also remained open when the Supreme Court issued its injunction. In these respects there is some similarity to our situation. Yet a clear and essential difference remains between *Texas v. New Mexico* and our case at this point in time. There is no specific formula by which Kansas' "entitlement" in any given year can now be determined. And no methodology to calculate depletions to usable State-line flow has yet been approved by me, let alone by the Supreme Court. Perhaps when the H-I model is modified and extended to cover the 1985-94 period, we will have the tool necessary to calculate depletions caused by post-compact pumping. But that is not the situation now.

Kansas also invokes *Texas v. New Mexico* for the principle that an injunction will lie to enforce the compact as

a federal statute (see 482 U.S. at 128), and that in such a situation neither a showing of actual injury nor a balancing of hardships is required. It is true that there are cases to that effect, but authority on the subject is not consistent. It should also be noted that while a compact approved by Congress becomes a "law of the United States," it is still a "contract." *Id.*

Thus, in connection with the antitrust laws, one district court has held that the Clayton Act is an expression of the public policy of the nation, and "embodies" irreparable injury in the violation of its provisions. "No further showing need be made by those directed to enforce [section 7] than that it is being violated or threatened with violation." *United States v. Ingersoll-Rand Co.*, 218 F.Supp. 530, 544-545 (W.D. Pa. 1963). In affirming that case, the Court of Appeals repeated the trial court's statement that it is not necessary to show an injury, only that the "threatened act is within the declared prohibition of Congress." 320 F.2d 509, 524 (C.A. 3d 1963). (The court, however, did go on to find an actual injury.) In contrast, other federal courts have held that the plaintiff must demonstrate significant threat of injury from an impending violation of the antitrust laws (*Ralph Rosenberg Court Reporters Inc. v. Fazio*, 811 F.Supp. 1432, 1442 [D. Hawaii 1993], citing *Zenith Radio Corp. v. Hazeltine Research, Inc.*, 395 U.S. 100, 130 [1969]), and even that "the normal principles of equity are applicable" in determining whether to issue preliminary injunctions in Clayton Act cases. *Kay Instrument Sales Co. v. Haldex Actiebolag*, 296 F.Supp. 578, 579 (S.D. N.Y. 1968). Moreover, even where a statute expressly authorizes an injunction for a statutory violation (as in the federal drug cases), the court is not

required to issue one, but should exercise its equitable discretion; "injunctive relief must be used sparingly." *United States v. Barr Laboratories, Inc.*, 812 F.Supp. 458, 486, 487-488 (D. N.J. 1993).

On the question of balancing of hardships, one federal district court refused to consider that test where the defendants had violated a statute by physically disrupting a church service. *Central Presbyterian Church v. Black Liberation Front*, 303 F.Supp. 894, 901 (E.D. Mo. 1969). However, in that case the defendants' conduct was actually criminal, and it would be hard to imagine what legally cognizable hardship they could have claimed. Other courts have undertaken to balance equities where a statute is involved. In the *Barr* case above cited, the court painstakingly reviewed the evidence as to each of the many drugs in question, sometimes siding with the Government and at other times with the defendant company. See also *X Corp. v. Doe*. 805 F.Supp. 1298 (D. Va. 1992), affirmed sub nom. *Under SEAL v. Under SEAL*, 17 Fed.3d 1435 (C.A.4th 1995, No. 93-1495).

In short, the effect of an underlying statute on a request for injunctive relief can be very difficult to determine. The decisions suggest that it may well depend on the particular statute and even on the particular facts. Moreover, that question is but part of the developing relationship between legislatures and the courts of equity. a subject which has attracted considerable critical comment in recent years. See, for example, Plater, *Statutory Violations and Equitable Discretion*, 70 Cal.L.Rev. 524 (1982); Shreve, *Federal Injunctions and the Public Interest*, 51 Geo.Wash.L.Rev. 382 (1983). Since the present request for an injunction is premature, it is not now necessary to

determine what impact our particular law (the compact) may have on the Court's equity armament.

Kansas has expressed understandable concern over the possibility of delays in bringing Colorado into current compliance with the compact. Colorado is now moving through its own statutory and administrative procedures in order to develop pumping controls and programs to offset depletions. However, in view of past experience, some skepticism on the part of Kansas is not unexpected. The previous efforts of the Colorado State Engineer to control pumping during the period from 1968 to 1975 met with widespread opposition. Twice the Colorado Supreme Court struck down his regulations. Report at 117-131. Nonetheless, conditions are now quite different.

The United States Supreme Court has determined that postcompact pumping in Colorado has caused material depletions of usable Stateline flows, in violation of the compact. Colorado recognizes that I may recommend, and the Supreme Court may decree, "whatever steps are necessary" to achieve compliance. RT Vol. 144 at 39. There is no prohibition against my "imposing management standards" upon Colorado should Colorado fail to do so through its own processes. *Id.*

At the next scheduled trial segments beginning October 30 and February 19, evidence will be received on the status of Colorado's efforts to achieve compliance. Kansas will also have the opportunity to provide testimony on the adequacy of such efforts, and to present compliance measures of its own. At the conclusion of those two trial segments, we should also have data for the years 1986-94 and, it is hoped, a hydrologic model that may be used to

determine depletions. Thereafter, it may be appropriate to revisit the issue of injunctive relief.

Accordingly, Kansas' Motion for Injunction is hereby denied without prejudice.

DATED: September 19, 1995.

/s/ Arthur L. Littleworth
ARTHUR L. LITTLEWORTH
Special Master

PROOF OF SERVICE BY MAIL

STATE OF CALIFORNIA, COUNTY OF RIVERSIDE

I am a citizen of the United States and a resident of the County aforesaid; I am over the age of eighteen years and not a party to the within entitled action; my business address is Best, Best & Krieger, 3750 University Avenue, 400 Mission Square, Riverside, California 92502.

I am readily familiar with Best, Best & Krieger's practice for collecting and processing correspondence for mailing with the United States Postal Service. Under that practice, all correspondence is deposited with the United States Postal Service the same day it is collected and processed in the ordinary course of business.

On September 19, 1995, I served the within ORDER DENYING KANSAS' MOTION FOR INJUNCTION by placing a copy of the document in a separate envelope for

each addressee named below and addressed to each such addressee as follows:

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Donald M. Gerstein
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Cheyenne, Wyoming 82002

On September 19, 1995, at the office of Best, Best & Krieger, 3750 University Avenue, 400 Mission Square, Riverside, California 92502, I sealed and placed each envelope for collection and deposit by Best, Best &

Krieger in the United States Postal Service, following ordinary business practices.

I declare under penalty of perjury under the laws of the State of California, that the foregoing is true and correct.

Executed on September 19, 1995, at Riverside, California.

/s/ Sandra L. Simmons
Sandra L. Simmons

APPENDIX – Exhibit 4

Order Denying Kansas' Motion to Adjust Trial Schedule, filed February 22, 1996

IN THE SUPREME COURT OF THE UNITED STATES

STATE OF KANSAS, Plaintiff, v. STATE OF COLORADO, Defendant, UNITED STATES OF AMERICA, Intervenor.	)	No. 105 Original October Term, 1985

ORDER DENYING KANSAS' MOTION TO ADJUST TRIAL SCHEDULE

(Filed Feb. 22, 1996)

On February 16, 1996 Kansas filed a motion to move the March 25, 1996 trial segment to June 17, 1996, combining it with the trial segment already set for that date. Kansas based its motion on the grounds: (1) that the trial in the Colorado Water Court for Division No. 2 on the proposed compliance Rules and Regulations has been set for March 18-29, 1996, and such Rules will not be effective until approval by that Court; and (2) that the parties have differences over pumping data for 1986-94, and changes to the H-I Model, which may be resolved with more time, but which now prevent the quantification of Compact violations for 1986-94 from being ready for presentation at the March 25, 1996 trial segment.

The March 25, 1996 trial segment is scheduled to address: Stateline depletions as determined by the H-I Model for the period 1986-94; whether accretions calculated by the H-I Model should offset depletions for the

1986-94 period; and continued developments in connection with Colorado's compliance program.

Colorado objects to the motion. Both States have filed briefs in support of their respective positions, and further argument was heard by conference call on February 21, 1996.

The fact that the Colorado Water Court proceedings may not be completed by the trial segment scheduled for March 25 does not require a delay in our proceedings, although the proposed Rules will not be effective without Water Court approval. Counsel for Colorado has indicated that the Colorado Water Court is well aware of the time considerations involved in the issues before it, and that a prompt decision may be expected. In any event, Kansas is not required to respond to the Colorado compliance efforts until our June 17 trial segment. Kansas is correct that the plans being developed under the proposed Rules involve the substance of the Colorado compliance effort. However, Colorado has given its assurance that these plans will be provided to Kansas as promptly as possible.

With respect to Stateline depletions for the 1986-94 period, it appears from the briefs and the conference call that the States will be unable to agree on the depletion amount. In part, the disagreement results from differences in pumping estimates, although those differences may yet be narrowed or even resolved. However, Colorado also argues that changes made by Kansas to the H-I Model account for some of the difference in the calculations. Kansas seems to minimize the impact of any such changes, putting its emphasis instead on Colorado's new

methodology for estimating pumping. Nonetheless, it appears that issues now exist over the use of the H-I Model. The States agreed to use the H-I Model to determine Stateline depletions, although it was also recognized that some additional changes in the Model or its calibration might be required. It is essential that any issues over the Model be resolved as early as possible. The scheduled March 25 trial segment becomes more, rather than less, important in this regard. A number of statements, allegations and denials appear in the briefs, but they have not influenced my decision on this motion. I believe, simply, that it would be better to be back in Court sooner rather than later.

Accordingly, the Kansas motion is denied. The February 21 date in Paragraph 9 of my December 7, 1995 Order for the exchange of expert reports, summaries of non-expert testimony, and exhibits is hereby changed to February 26, 1996.

Dated: February 22, 1996

/s/ Arthur L. Littleworth
Arthur L. Littleworth
Special Master

PROOF OF SERVICE BY MAIL

STATE OF CALIFORNIA, COUNTY OF RIVERSIDE

I am a citizen of the United States and a resident of the County aforesaid; I am over the age of eighteen years and not a party to the within entitled action; my business address is Best, Best & Krieger, 3750 University Avenue, 400 Mission Square, Riverside, California 92502.

I am readily familiar with Best, Best & Krieger's practice for collecting and processing correspondence for mailing with the United States Postal Service. Under that practice, all correspondence is deposited with the United States Postal Service the same day it is collected and processed in the ordinary course of business.

On February 22, 1996, I served the within **ORDER DENYING KANSAS' MOTION TO ADJUST TRIAL SCHEDULE** by placing a copy of the document in a separate envelope for each addressee named below and addressed to each such addressee as follows:

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General Litigation Section
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On February 22, 1996, at the office of Best, Best & Krieger, 3750 University Avenue, 400 Mission Square, Riverside, California 92502, I sealed and placed each envelope for collection and deposit by Best, Best & Krieger in the United States Postal Service, following ordinary business practices.

I declare under penalty of perjury under the laws of the State of California, that the foregoing is true and correct.

Executed on February 22, 1996, at Riverside, California..

/s/ Sandra L. Simmons
Sandra L. Simmons

APPENDIX – Exhibit 5

Modification of April 26, 1996 Order re Trial Proceedings, filed July 10, 1996

IN THE SUPREME COURT OF THE UNITED STATES

STATE OF KANSAS,	)	
Plaintiff,	)	
	)	No. 105 Original
v.	)	October Term, 1995
STATE OF COLORADO,	)	
	)	
Defendant,	)	
UNITED STATES OF AMERICA,	)	
	)	
Intervenor.	)	

MODIFICATION OF APRIL 26, 1996 ORDER RE TRIAL PROCEEDINGS

(Filed Jul 10, 1996)

Based upon the agreement of the parties, and due to the untimely death of Kansas expert witness Brent E. Spronk, Paragraphs 5, 7, and 9 of my Order of April 26, 1996, entitled "Modification of December 7, 1995 Order re Trial Proceedings" are hereby supplemented and amended to read as follows:

5. That the parties may take such depositions as may be required in connection with the subject of the September 30, 1996 trial segment hereinafter discussed, according to the following schedule:

July 15: Deposition by Kansas of Mr. Dewayne Schroeder; Deposition by Colorado of Mr. Steven P. Larson.

July 2-August 2: Depositions by Kansas of Mr. Hal D. Simpson and other persons necessary for Kansas to prepare its response to the current Colorado compliance efforts.

August 26-30: Depositions by Colorado of Kansas' witnesses on Kansas' response to the current Colorado compliance efforts.

Each state shall make its best efforts to schedule and complete depositions during the specified periods. The Special Master's approval is required for any depositions outside of the designated periods, if the states cannot reach agreement.

7. That trial shall resume on September 30, 1996, at 9:30 a.m. in the United States Court of Appeals, Courtroom 3, 125 South Grand Avenue, Pasadena, California, to consider evidence on these additional subjects: Mr. Schroeder's testimony on additional proposed changes to the H-I Model for purposes of determining Stateline depletions for the period 1986-94; rebuttal testimony by Kansas on the 1986-94 quantification, including rebuttal to Mr. Schroeder's additional proposed changes to the H-I Model; continued testimony by Mr. Simpson on the Colorado program to comply with the Compact; and Kansas' response to the current Colorado compliance efforts, including evidence presented during earlier trial segments, and any other evidence it may wish to present in regard to compliance. In the event this portion of the trial is not completed during the week of September 30, 1996, the trial shall resume on October 15, 1996, and continue until October 18, 1996, as necessary.

9. On June 26, 1996, Kansas provided Colorado with the opinions of its experts on Mr. Schroeder's additional proposed changes to the H-I Model. By July 12, 1996, Colorado shall provide Kansas with an update to the September 29, 1995 report by the State Engineer of Colorado setting forth any additional actions being taken by

Colorado to comply with the Arkansas River Compact since the March 30, 1996 trial segment including the approval of plans to divert tributary ground water pursuant to the Amended Rules and Regulations Governing the Diversion and Use of Tributary Ground Water in the Arkansas River Basin, Colorado, being developed or used by entities within Colorado, and any additional data collection, monitoring, and enforcement activities. By August 19, 1996, Kansas shall provide Colorado with expert reports, computer files and exhibits concerning the evidence which Kansas proposes to present during the September 30 trial segment, concerning Kansas' response to the current Colorado compliance efforts.

By September 6, 1996, Kansas shall also provide Colorado with the reports of its experts, together with any computer files and exhibits, of the testimony which it proposes to present concerning rebuttal on the 1986-94 quantification (other than evidence which Kansas proposes to present concerning Mr. Schroeder's additional proposed changes to the H-I Model, which were provided on June 26, 1996). By September 18, 1996, Colorado shall provide Kansas with any reports of its experts, together with computer files and exhibits, of any testimony which it proposes, if allowed by the Special Master, to present concerning any surrebuttal on the 1986-94 quantifications. Both states will use best efforts to avoid the need for depositions on rebuttal and surrebuttal testimony. If depositions are necessary, they will be scheduled at the

beginning of or during trial as approved by the Special Master.

DATED: July 10, 1996.

/s/ Arthur L. Littleworth
ARTHUR L. LITTLEWORTH
Special Master

PROOF OF SERVICE BY MAIL

STATE OF CALIFORNIA, COUNTY OF RIVERSIDE

I am a citizen of the United States and a resident of the County aforesaid; I am over the age of eighteen years and not a party to the within entitled action; my business address is Best, Best & Krieger, 3750 University Avenue, 400 Mission Square, Riverside, California 92502.

I am readily familiar with Best, Best & Krieger's practice for collecting and processing correspondence for mailing with the United States Postal Service. Under that practice, all correspondence is deposited with the United States Postal Service the same day it is collected and processed in the ordinary course of business.

On July 10, 1996, I served the within MODIFICATION OF APRIL 26, 1996 ORDER RE TRIAL PROCEEDINGS by placing a copy of the document in a separate envelope for each addressee named below and addressed to each such addressee as follows:

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On July 10, 1996, at the office of Best, Best & Krieger, 3750 University Avenue, 400 Mission Square, Riverside, California 92502, I sealed and placed each envelope for collection and deposit by Best, Best & Krieger in the United States Postal Service, following ordinary business practices.

I declare under penalty of perjury under the laws of the State of California, that the foregoing is true and correct.

Executed on July 10, 1996, at Riverside, California.

/s/ Sandra L. Simmons
Sandra L. Simmons

APPENDIX – Exhibit 6

Stipulation re Depletions to Usable Stateline Flow
for 1950-85, filed October 30, 1995

IN THE SUPREME COURT OF THE UNITED STATES
No. 105, Original
October Term 1985

STATE OF KANSAS,

Plaintiff,

v.

STATE OF COLORADO,

Defendant,

and

UNITED STATES OF AMERICA,

Defendant-Intervenor.

STIPULATION
RE DEPLETIONS TO USABLE STATELINE FLOW FOR 1950-85

(Filed Oct. 30, 1995)

The State of Kansas and the State of Colorado stipulate and agree, subject to approval by the Special Master, as follows:

1. This Stipulation is made as a compromise between Kansas and Colorado for the complete and final settlement of the amount of depletions to usable Stateline flow caused by post-compact well pumping in Colorado for the period 1950-85.

2. Depletions to usable Stateline flow caused by post-compact well pumping in Colorado for the period

1950-85 have been determined using the Kansas Hydrologic-Institutional (H-I) Model, using the Durbin usable flow method with the Larson coefficients. Kansas and Colorado have agreed to joint exhibits which set forth the amounts of the depletions and accretions predicted by the Kansas H-I Model, using the Durbin usable flow method with the Larson coefficients, for the period 1950-85.

3. To avoid the necessity for further trial and as a compromise and settlement of their differences with respect to whether or not accretions to usable Stateline flow should offset depletions to usable Stateline flow, Kansas and Colorado have agreed that in calculating depletions to usable Stateline flow for the period 1950-85 with the Kansas H-I Model, using the Durbin usable flow method with the Larson coefficients, accretions to usable Stateline flow predicted by the Kansas H-I Model should be allowed to offset depletions to usable Stateline flow during the same season (November through March and April through October), but not otherwise.

4. The depletions to usable Stateline flow caused by post-compact well pumping in Colorado for the period 1950-85 calculated in accordance with this Stipulation are 328,505 acre-feet, as shown on Joint Exhibit 178.

5. Kansas and Colorado have agreed to this Stipulation with the understanding that neither State will be precluded from arguing that accretions to usable Stateline flow predicted by the Kansas H-I Model in years after 1985 should or should not offset depletions to usable Stateline flow in years after 1985, and with the understanding that this Stipulation shall be given no weight by

the Court in determining whether or to what extent accretions may be offset against depletions for years after 1985.

Respectfully submitted this 30th day of October, 1995.

STATE OF KANSAS

/s/ John B. Draper
JOHN B. DRAPER
Counsel of Record

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Attorneys for the State of Kansas

STATE OF COLORADO

/s/ David W. Robbins
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Attorneys for the State
of Colorado

APPROVED:

/s/ Arthur L. Littleworth
Arthur L. Littleworth
Special Master

APPENDIX – Exhibit 7

Stipulation re Pumping in Colorado for 1986-94,
filed October 1, 1996

NO. 105, ORIGINAL

In The
SUPREME COURT OF THE UNITED STATES
October Term, 1995

STATE OF KANSAS, Plaintiff

v.

STATE OF COLORADO

STIPULATION RE PUMPING IN COLORADO FOR 1986-94

(Filed Oct. 1, 1996)

The State of Kansas and the State of Colorado stipulate and agree, subject to approval by the Special Master, as follows:

1. This Stipulation is made as a compromise between Kansas and Colorado on the amount of well pumping in Colorado, in the area modeled by the Kansas H-I Model, to be used for the purpose of quantifying depletions to usable stateline flow for the period of 1986-94.

2. For the purpose of quantifying depletions of usable stateline flow, Kansas and Colorado have agreed to use the pumping estimates developed by the Colorado experts for the period 1986-94 and agree that Kan. Exh. 787, showing the depletions and accretions for the period 1986-94 predicted by the Kansas March 1996 version of the H-I Model using the pumping estimates developed by the Colorado experts, should be admitted into evidence.

3. Kansas and Colorado do not agree on the appropriate version of the Kansas H-I Model which should be used to determine depletions to usable stateline flow for the period of 1986-94 and have agreed to this Stipulation with the understanding that neither State will be precluded from arguing which version of the model is appropriate to determine depletions to usable stateline flow for the period 1986-94.

4. While Kansas has agreed to use the pumping estimates developed by the Colorado experts for the period 1986-94 as a compromise for the purpose of quantifying depletions of usable stateline flow, Kansas does not accede to the methodology used to develop those estimates and does not accede to any implication for other periods of time.

Respectfully submitted this 1st day of October, 1996.

STATE OF KANSAS

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Attorneys for the State of Colorado

Approved:

/s/ Arthur L. Littleworth
Arthur L. Littleworth
Special Master

APPENDIX – Exhibit 8

Franzoy's Table 1 of Kansas Exhibit 801

PRIVILEGED AND CONFIDENTIAL COMMUNICATION
ATTORNEY WORK PRODUCT

KANSAS v. COLORADO
Arkansas River Valley
Table 1. Maximum Irrigation Efficiency
05-Sep-96
irref996.wb2

CANAL NAME	IRRIGATED ACREAGE 1980	EST. MAX. EFF. (1) %	DOMINANT SLOPE (2) %	EST. MAX. EFF. (3) %	EST. T.W. REUSE (6) %	ADJ. FOR T.W. REUSE %	MAX. SYST. EFF. %
Bessemer	19,130	55	0.5 - 1.0	35 - 50	10-15	5	60
Booth-Orchard	1,160	n/a			n/a	n/a	n/a
Excelsior (Sprinkler)	1,940	80	0 - 1.0	65 - 85	0	0	80
Excelsior (Gravity)	See Note (4)	55	0 - 1.0	35 - 50	<5	0	55
Collier	770	n/a	n/a	n/a	n/a	n/a	n/a
Colorado	35,300	55	0.5 - 1.0	35 - 50	<10	0	55
Rocky Ford Highline	22,730	55	0.5 - 1.0	35 - 50	10-15	5	60
Oxford Farmers	4,450	55	0.5 - 1.0	35 - 50	10-15	5	60
Otero	5,060	55	0.5 - 1.0	35 - 50	<5	0	55
Holbrook	14,520	50	0.5 - 1.5	35 - 50	5-10	5	55
Catlin	16,430	50	0.5 - 1.5	35 - 50	5-10	5	55
Rocky Ford	7,820	50	0.5 - 1.5	35 - 50	<5	0	50
Ft. Lyon	94,030	55	0.5 - 1.0	35 - 50	33-50	10	65
Baldwin-Stubbs	1,520	n/a	n/a	n/a	n/a	n/a	n/a
Las Animas	7,820	60	0 - 1.0	35 - 50	<5	0	60
Ft. Bent	5,880	65	0 - 1.0	35 - 50	<5	0	65
Keesee	1,950	65	0 - 1.0	35 - 50	<5	0	65
Amity	40,350	55	0.5 - 1.5	35 - 50	25-33	10	65
Lamar	5,080	70	0 - 1.0	50 - 70	<5	0	70
Hyde	1,610	n/a	0 - 1.0	35 - 50	n/a	n/a	n/a
Manvel	4,360	70	0 - 1.0	50 - 70	<5	0	70
XY-Graham	7,710	60	0 - 1.0	35 - 50	<5	0	60
Buffalo	7,380	60	0.5 - 1.5	35 - 50	<5	0	60
Sisson	540	65	1 - 1.0	35 - 50	<5	0	65
Other-Pueblo (5)	620	n/a	n/a	n/a	n/a	n/a	n/a
Other-Crowley (5)	0	n/a	n/a	n/a	n/a	n/a	n/a
Other-Otero (5)	510	n/a	n/a	n/a	n/a	n/a	n/a
Other-Bent (5)	400	n/a	n/a	n/a	n/a	n/a	n/a
Other-Prowers-Sprinkler (5	9,530	80	1.0 - 3.0	65 - 85	0	0	80
Other-Prowers-Gravity (5)	See Note (4)	50	1.0 - 3.0	35 - 50	n/a		50
TOTAL	318,600						
AREA SURVEYED	312,010						
AVERAGE (7)		56					62

NOTES:

(1) Efficiency estimates by C. Eugene Franzoy, P.E. based on field trip January 3-4, 1996.

(2) Dominant slope based on review of Soil Conservation Service soil surveys.

(3) Efficiency based on Soil Conservation Service data sheet for graded furrow and sprinkler.

(4) Area contains a mix of sprinkler and gravity irrigation. The acreage of each method not available.

(5) Area outside of canal system.

(6) Tailwater reuse estimate by C. Eugene Franzoy, P.E. based on field trip April 23-24, 1996.

(7) The average is determined by multiplying the efficiency by the acreage the canal system serves, totalling the multiplied values and dividing by the sum of the canal system acreages.

APPENDIX - EXHIBIT 8

APPENDIX – Exhibit 9

Stipulation re Offset Account in John Martin Reservoir, filed April 3, 1997, and Arkansas River Compact Administration Resolution

IN THE SUPREME COURT OF THE UNITED STATES

STATE OF KANSAS, Plaintiff,	)	
v.	)	No. 105, Original October Term 1996
STATE OF COLORADO, Defendant,	)	
and	)	
UNITED STATES OF AMERICA, Defendant-Intervenor.	)	

STIPULATION RE OFFSET ACCOUNT IN JOHN MARTIN RESERVOIR

(Filed Apr. 03, 1997)

This Stipulation is entered into this 17th day of March, 1997, by the State of Kansas [hereinafter "Kansas"] and the State of Colorado [hereinafter "Colorado"], subject to approval by the Special Master of the United States Supreme Court.

RECITALS:

WHEREAS, Article IV-D of the Arkansas River Compact provides as follows:

> This Compact is not intended to impede or prevent future beneficial development of the Arkansas River basin in Colorado and Kansas by Federal or State agencies, by private enterprise, or by combinations thereof, which may involve construction of dams, reservoirs and

> other works for the purposes of water utilization and control, as well as the improved or prolonged functioning of existing works: Provided, that the waters of the Arkansas River, as defined in Article III, shall not be materially depleted in usable quantity or availability for use to the water users in Colorado and Kansas under this Compact by such future development or construction;

and

WHEREAS, the United States Supreme Court has determined that post-Compact well pumping in Colorado has caused material depletions of the usable Stateline flows of the Arkansas River in violation of the Arkansas River Compact [hereinafter the "Compact"], *Kansas v. Colorado*, 115 S.Ct. 1733 (1995); and

WHEREAS, Colorado desires to continue to allow ground water pumping by its water users in excess of the pre-Compact entitlement of 15,000 acre-feet per year determined by the United States Supreme Court as long as any depletions to usable Stateline flows caused by such pumping are replaced; and

WHEREAS, the issue of Compact compliance by Colorado is presently pending before the Special Master appointed by the United States Supreme Court; and

WHEREAS, an account in John Martin Reservoir [hereinafter the "Reservoir"] is not necessary for Colorado's compliance with the Compact, but an account would be of benefit to Colorado by facilitating compliance with the Compact by Colorado and its water users to the extent that Colorado allows post-Compact well pumping by its water users in excess of the pre-Compact

pumping entitlement of 15,000 acre-feet per year, and Colorado has requested such an account; and

WHEREAS, the Arkansas River Compact Administration [hereinafter the "Administration"] has the authority to create the Offset Account as provided for in the Resolution Concerning an Offset Account in John Martin Reservoir for Colorado Pumping [hereinafter the "Resolution"], but neither the Administration nor either of its member states has any obligation to create the Offset Account; and

WHEREAS, the Offset Account will create benefits for water users in Kansas but also monitoring and accounting burdens for Kansas; and

WHEREAS, the existence of an account in the Reservoir does not, in and of itself, assure Colorado's compliance with the Compact; and

WHEREAS, the Administration and the Chief of Engineers of the Army Corps of Engineers are jointly approving concurrently herewith the Resolution establishing a new storage account in the Reservoir known as the "Offset Account in John Martin Reservoir for Colorado Pumping" [hereinafter the "Offset Account"]; and

WHEREAS, Kansas and Colorado desire to reach an agreement on the credit which Colorado shall receive for the delivery of water released from the Offset Account upon demand by Kansas, subject to approval by the Special Master of the United States Supreme Court;

NOW, THEREFORE, Kansas and Colorado stipulate and agree as follows:

1. In accordance with the Resolution, the Colorado State Engineer shall determine the extent to which water delivered to the Offset Account is fully consumable. Colorado understands that Kansas may not agree with the Colorado State Engineer's determination and agrees that the Colorado State Engineer's determination shall not be binding on Kansas in the event of a disagreement. However, both States recognize that it is useful to have the Colorado State Engineer make the determination in the first instance. In the event that Kansas disagrees with the Colorado State Engineer's determination of the extent to which water is fully consumable, Kansas shall notify Colorado within a reasonable period of time and the States shall make a good-faith attempt to resolve the disagreement. In the event the disagreement cannot be resolved by the States, Colorado agrees that it shall have the burden to establish the extent to which water delivered to the Offset Account is fully consumable.

2. With regard to water delivered to the Offset Account for the purpose of offsetting depletions to usable Stateline flows, which is released at the demand of Kansas pursuant to the Resolution, Colorado shall receive credit for the delivery of such water at the Stateline (less transit losses determined in accordance with paragraph 3 below) as a replacement of depletions to usable Stateline flows which occur after the effective date of the Resolution to the extent such water is fully consumable; provided, however, that a demand for a release of water from the Offset Account by Kansas shall not constitute an admission by Kansas that the water released from the Offset Account and delivered to the Stateline was in fact fully consumable. Antecedent flows at the Stateline shall

not be included in the calculated delivery. To the extent the credit for the delivery of water at the Stateline to offset depletions to usable Stateline flows exceeds calculated depletions to usable Stateline flows which occurred after the date of the Resolution, the credit shall be applied to reduce future depletions to usable Stateline flows. Colorado shall receive no credit, however, for spills of water from the Offset Account or for releases of Storage Charge Water (as defined in the Resolution) or Stateline Return Flow (as defined in the Resolution) as a replacement of depletions to usable Stateline flows.

3. Transit losses on releases of water from the Offset Account for delivery to the Stateline for the purpose of offsetting depletions to usable Stateline flows shall be determined using the transit losses for Subreach 6, including bank and channel storage, as set forth in the U.S. Geological Survey Water Resources Investigations 78-75, unless the States agree to use a different method or the United States Supreme Court directs otherwise. The States agree to cooperate with each other, the Administration, and the U.S. Geological Survey to improve the method of determining transit losses between John Martin Dam and the Stateline. Transit losses on releases from the Offset Account for delivery to the Stateline for the purpose of offsetting depletions to usable Stateline flow shall be borne by such releases.

4. Colorado acknowledges that use of the Offset Account may result in additional monitoring costs to Kansas. Colorado agrees that Kansas is not waiving its right to claim reasonable compensation from Colorado for such additional monitoring expenses incurred by Kansas after the effective date of the Resolution. Colorado

shall timely share relevant information with Kansas concerning use of the Offset Account in a manner that will minimize Kansas' monitoring costs. Each year, the States shall discuss further ways to minimize such costs.

5. Neither the adoption of the Resolution nor the establishment or operation of the Offset Account shall constitute a waiver of either State's rights under the Compact (if such a waiver is possible as a matter of law) or prejudice the ability of either State to represent its interests in present or future cases or controversies before the Administration or any court of competent jurisdiction; except that actual storage of water in the Offset Account, transfers authorized by the Resolution, and credits for deliveries of water to the Stateline in accordance with this Stipulation shall be considered in determining Colorado's Compact compliance; and provided further that Colorado shall receive credit for the delivery of water at the Stateline as a replacement of depletions to usable Stateline flows in accordance with this Stipulation.

DATED, this 17 day of March, 1997.

STATE OF KANSAS

/s/ John B. Draper
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Special Assistant Attorney General

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APPROVED:

/s/ Arthur L. Littleworth
Arthur L. Littleworth
Special Master

RESOLUTION CONCERNING AN OFFSET ACCOUNT IN JOHN MARTIN RESERVOIR FOR COLORADO PUMPING

WHEREAS, Article IV-D of the Arkansas River Compact provides as follows:

> The Compact is not intended to impede or prevent future beneficial development of the Arkansas River basin in Colorado and Kansas by Federal or State agencies, by private enterprise, or by combinations thereof, which may involve construction of dams, reservoirs and other works for the purposes of water utilization and control, as well as the improved or prolonged functioning of existing works: Provided, that the waters of the Arkansas River, as defined in Article III, shall not be materially depleted in usable quantity or availability for use to the water users in Colorado and Kansas under this Compact by such future development or construction;

and

WHEREAS, the United States Supreme Court has determined that post-Compact well pumping in the State of Colorado has caused material depletions of usable Stateline flows of the Arkansas River in violation of the Arkansas River Compact [hereinafter the "Compact"], *Kansas v. Colorado*, 115 S.Ct. 1733 (1995); and

WHEREAS, the State of Colorado [hereinafter "Colorado"] desires to continue to allow ground water pumping by its water users in excess of the pre-Compact pumping entitlement of 15,000 acre-feet per year determined by the United States Supreme Court as long as any

depletions to usable Stateline flows caused by such pumping are replaced; and

WHEREAS, Section 2 of the Act of Congress approving the Compact provides in relevant part as follows:

> [T]he Chief of Engineers is hereby authorized to operate the conservation features of the John Martin Reservoir Project in a manner conforming to such Compact with such exceptions as he and the Administration created pursuant to the Compact may jointly approve[;]

and

WHEREAS, the issue of Compact compliance by Colorado is presently pending before the Special Master appointed by the United States Supreme Court; and

WHEREAS, an account in John Martin Reservoir [hereinafter the "Reservoir"] is not necessary for Colorado's compliance with the Compact, but an account would be of benefit to Colorado by facilitating compliance with the Compact by Colorado and its water users to the extent that Colorado allows post-Compact well pumping by its water users in excess of the pre-Compact entitlement of 15,000 acre-feet per year, and Colorado has requested such an account

WHEREAS, the Offset Account [as hereinafter defined] would create benefits for water users in Kansas but also monitoring and accounting burdens for the State of Kansas [hereinafter "Kansas"]; and

WHEREAS, the existence of an account in the Reservoir does not, in and of itself, assure compliance with the Compact by Colorado and its water users; and

WHEREAS, the Arkansas River Compact Administration [hereinafter the "Administration"] recognizes that it has the authority to create the Offset Account as provided for herein, but that neither the Administration nor either of its member states has any obligation to create the account provided for in this Resolution; and

WHEREAS, concurrently with the adoption of this Resolution, Colorado and Kansas are entering into a Stipulation Re Offset Account in John Martin Reservoir [hereinafter the "Stipulation"];

NOW THEREFORE, BE IT RESOLVED that, pursuant to Section 2 of the Act of Congress approving the Compact, the Administration and the Chief of Engineers of the Corps of Engineers or his duly authorized representative, jointly approve a storage account in the Reservoir to be established and operated as follows:

1. There is hereby established a new storage account in the Reservoir to be known as the "Offset Account in John Martin Reservoir for Colorado Pumping" [hereinafter the "Offset Account"]. The size of the Offset Account shall be 20,000 acre-feet. Deliveries of water to the Offset Account shall be stored in the conservation pool but shall not be inflows into the Reservoir which accrue to conservation storage, and water in the Offset Account shall reside below elevation 3,851 feet above mean sea level (bottom of flood control storage). The establishment of the Offset Account is for the primary purpose of facilitating Compact compliance by Colorado and its water users after the effective date of this Resolution and is not for the purpose of repayment for violations of the Compact by Colorado prior to the effective

date of this Resolution or replacement to Colorado ditches except as authorized herein. The intent of this Resolution is that, to the extent that Colorado allows post-Compact well pumping in Colorado in excess of the pre-Compact entitlement of 15,000 acre-feet per year, any depletions to usable Stateline flows caused by such pumping be contemporaneously offset by delivering replacement water to the Stateline or by making replacement water available in the Offset Account where it can be called for by Kansas in accordance with this Resolution.

2. The Offset Account shall be separate from and in addition to the accounts established by the Administration's Resolution Concerning an Operating Plan for John Martin Reservoir as revised through December 11, 1984 [hereinafter the "1980 Operating Plan"] and the John Martin Reservoir Permanent Pool authorized by the Administration Resolution of August 14, 1976 [hereinafter the "Permanent Pool"].

3. The Colorado State Engineer or his delegate [hereinafter the "Colorado State Engineer"] may deliver or permit the delivery by Colorado water users of water to the Offset Account upon timely notice to the Kansas Chief Engineer or his delegate [hereinafter "Kansas Chief Engineer"]. Such notice shall specify and document the following: the source of the water delivered, the amount of water, the purpose for which the water is delivered, the time of delivery, the rate of delivery, the extent to which the water is fully consumable, and the quantity, timing, and location of any associated return flows.

4. Only water approved for storage in the Offset Account by the Colorado State Engineer may be delivered to the Offset Account, provided that adequate transit losses shall be charged during delivery of water to the Offset Account, which losses shall be determined by the Colorado State Engineer using the method set out in the U.S. Geological Survey Water Resources Investigations 78-75 (Sept. 1978) [hereinafter the "Livingston Formula". At the time of deliver of water to the Offset Account, the Colorado State Engineer shall determine the extent to which water delivered to the Offset Account is fully consumable and shall thereafter demand the release of any water necessary to maintain historical return flows to Colorado ditches and Stateline from deliveries of water historically used for agricultural irrigation; provided, however, that the Kansas Chief Engineer may, at his option, direct that water necessary to maintain historical return flows to the Stateline [hereinafter "Stateline Return Flow"] remain in the Offset Account or be transferred to the Kansas account provided for in Section II of the 1980 Operating Plan [hereinafter "Kansas Section II Account"] for later release, and provided further, that the Colorado State Engineer's determination of the extent to which water delivered to the Offset Account is fully consumable shall not be binding on the Administration or Kansas. Once the Colorado State Engineer has determined the extent to which the water delivered to the Offset Account is fully consumable or is Stateline Return Flow, and has notified the Kansas Chief Engineer in accordance with paragraph 3 above, the Kansas Chief Engineer may demand the release of the water in the Offset Account which is fully consumable at any time and at any rate and

may demand the release or direct the transfer of water in the Offset Account which is Stateline Return Flow at any time and at any rate.

5. Evaporation charges shall be made against water stored in the Offset Account in the manner set forth in Subsection II F of the 1980 Operating Plan. The evaporation charges shall be prorated amongst conservation storage and the accounts, including the offset Account, according to the amounts in them. Evaporation from water in the Offset Account shall be charged against Colorado until:

A. The water is released or transferred in accordance with this Resolution, or

B. Thirty days after the Colorado State Engineer has determined and notified the Kansas Chief Engineer of the estimated monthly net depletion to usable Stateline flows caused by post-Compact diversions of tributary ground water from the Valley Fill Aquifer and surficial aquifers along the Arkansas River between Pueblo Dam and the Stateline ("the estimated monthly net depletion of usable Stateline flows"), to the extent the Kansas Chief Engineer has not previously demanded the release of water available for replacement of the Offset Account in an amount equal to or greater than the estimated monthly net depletion to usable Stateline flows, the evaporation loss on that amount of water or portion thereof shall thereafter be charged to Kansas. In order to determine the estimated monthly net depletion to usable Stateline flows for

purposes of this paragraph only, the Colorado State Engineer shall use the following procedure unless he and the Kansas Chief Engineer agree otherwise: the Colorado State Engineer shall use the presumptive stream depletions established in Rule 4.2 of the Amended Rules and Regulations Governing the Diversion and Use of Tributary Ground Water in the Arkansas River Basin, Colorado, effective June 1, 1996 [hereinafter "Amended Rules"] and unit response functions presently utilized in accordance with the Amended Rules to determine stream depletions at the Stateline caused by post-Compact diversions of tributary ground water from the Valley Fill Aquifer and surficial aquifers along the Arkansas River between Pueblo Dam and the Stateline. Further, the Colorado State Engineer shall use the same procedures currently used under the Amended Rules to determine the timing and location of return flows from diversions of imported waters and other augmentation water in determining net stream depletions at the Stateline. For the summer storage season in the Reservoir (April 1-October 31), the Colorado State Engineer shall assume that net depletions to usable Stateline flows are 81.9 percent of the net stream depletions at the Stateline, and for the winter storage season (November 1-March 31), the Colorado State Engineer shall assume that net depletions to usable Stateline flows are 34.9 percent of the net stream depletions at the Stateline; provided that if the monthly Stateline flow exceeds 30,000 acre-feet during the summer storage

season or 7,500 acre-feet during the winter storage season, no depletion to usable Stateline flows shall be determined for such months for the purpose of this paragraph.

Notwithstanding paragraph B above, until thirty days after the Colorado State Engineer has determined and notified the Kansas Chief Engineer of the quantity and timing of any estimated Stateline Return Flow in the Offset Account, and the time for release of such water to the Stateline has passed, the evaporation loss on that amount of Stateline Return Flow shall be charged to Colorado, but shall thereafter be charged to Kansas.

6. In accordance with the provisions of paragraphs 3 and 4 above, the Colorado State Engineer may deliver or permit the delivery of water by Colorado water users to the Offset Account, in an amount not to exceed 1,500 acre-feet per Compact year, for the purpose of replacing depletions to the inflows to conservation storage caused by post-Compact well pumping in Colorado and may (1) direct the transfer of such water from the Offset Account to conservation storage to replace depletions to the inflows to conservation storage, or (2) to the extent such water is not needed to replace depletions to the inflows to conservation storage, may change the prior designation of water previously designated for the purpose of transfer to conservation storage. Once the Colorado State Engineer has notified the Kansas Chief Engineer of the change of designation, such water may be released or transferred in accordance with this Resolution.

7. Releases from the Offset Account may be made simultaneously with deliveries into the Offset Account.

However, such simultaneous releases and deliveries cannot create a deficit in the Offset Account.

8. Transit losses for releases from the Offset Account shall not be replenished from the Kansas transit loss account. Transit losses associated with the release of Stateline Return Flow from the Offset Account shall be replaced by the entity which delivered such Stateline Return Flow to the Offset Account, provided that any increase in transit losses which results if the Kansas State Engineer directs that Stateline Return Flow remain in the Offset Account and calls for the release of such Stateline Return Flow at a later time shall be borne by Kansas. Such transit losses on releases of Stateline Return Flow shall be determined using the Livingston Formula for Subreach 6, removing bank and channel storage from the calculation, unless the Colorado State Engineer and the Kansas Chief Engineer agree otherwise. In order to ensure the arrival of releases of Stateline Return Flow at the Stateline if the Kansas Chief Engineer calls for the release of such Stateline Return Flow during the summer storage season in the Reservoir (April 1-October 31), an amount of water equal to the transit losses determined using the Livingston Formula for Subreach 6, including bank and channel storage, shall be released with the Stateline Return Flow and shall be charged to the entity which delivered the Stateline Return Flow, except that Kansas shall bear any increase in evaporation resulting from the summer storage release.

9. Notwithstanding other provisions of this Resolution, 500 acre-feet of fully consumable water shall be delivered by Colorado or Colorado water users to the Offset Account by April 1 of each year or within two

weeks after this Resolution becomes effective, whichever is later, which delivery shall be a prerequisite for Colorado's right to deliver or permit the delivery by Colorado water users of up to 10,000 acre-feet of water (including the said 500 acre-feet) to the Offset Account pursuant to this Resolution during the period until the next succeeding April 1. For delivery of water to the Offset Account in excess of 10,000 acre-feet during each period, five percent of the amount delivered shall be allocated to Kansas. The said 500 acre-feet and five percent of any water delivered in excess of 10,000 acre-feet during each period [hereinafter "Storage Charge Water"] shall be allocated to Kansas, not for offset of depletions of usable flow at the Stateline but as part of Kansas' equitable share of the benefits arising from the creation of the Offset Account in the Reservoir. The Kansas Chief Engineer may direct that Storage Charge Water be transferred to the Kansas Section II Account or may demand the release of Storage Charge Water at any time and at any rate. If Storage Charge Water is retained in the Offset Account, Kansas shall bear the evaporation after April 1. Colorado water users shall bear the evaporation prior to April 1. Any shortfall due to evaporation in the 500 acre-foot April 1 delivery requirement shall be made up out of the next delivery of water after April 1 by Colorado water users. Kansas shall bear the transit losses associated with the release of Storage Charge Water. Such transit losses shall be calculated using the Livingston Formula for Subreach 6, unless the Colorado State Engineer and the Kansas Chief Engineer agree otherwise.

10. No transfers, releases or exchanges shall be made of water in the Offset Account except releases and

transfers authorized by this Resolution or approved by the Administration.

11. Not later than December 1 of each year, the Colorado State Engineer shall make an accounting of the operation under this Resolution for the previous Compact year available to the Operations Committee of the Administration and to interested parties.

12. In recognition of the fact that the operation of the Offset Account is for the primary purpose of facilitating Compact compliance by Colorado in connection with increased post-Compact pumping by Colorado water users, the Colorado State Engineer shall report to the Administration and the Kansas Chief Engineer on a monthly basis the timing and amount of deliveries to the Offset Account, the monthly pumping in location and amount in excess of Colorado's pre-Compact entitlement, and Colorado's monthly accounting of Compact compliance, including documentation not already provided and a report of the status of water delivered to the Offset Account, within two months of the end of the month reported. The Administration recognizes that use of this Offset Account to facilitate Compact compliance by Colorado after the effective date of this Resolution may result in additional monitoring costs to Kansas. The Administration recognizes that Kansas is not waiving its right to claim reasonable compensation from Colorado for such additional monitoring expenses incurred by Kansas after the effective date of this Resolution. The Colorado State Engineer shall timely share relevant information with the Kansas Chief Engineer concerning use of the Offset Account in a manner that will minimize Kansas' monitoring costs. Each year the Colorado State Engineer and the

Kansas Chief Engineer shall discuss further ways to minimize such costs.

13. In the event that runoff conditions occur in the Arkansas River basin upstream from the Reservoir that cause water to spill from the Reservoir, then water stored in the Permanent Pool in excess of 10,000 acre-feet shall spill before water stored in the accounts granted in Subsections III A, B, and C of the 1980 Operating Plan, which shall spill before the water stored in the Offset Account, which shall spill before the accounts granted in Section II of the 1980 Operating Plan, which shall spill before the Kansas Transit Loss Account, all of which shall spill before conservation storage.

14. Water available under priority rights decreed to the ditches of Colorado Water District 67 [hereinafter "District 67"] may be stored in the Offset Account only when no water is accruing to conservation storage, provided that return flows shall be maintained and accounted for in accordance with paragraphs 3 and 4 above; and water may be transferred into the Offset Account from accounts of the ditches of District 67 in the Reservoir provided for in Section II of the 1980 Operating Plan in accordance with this Resolution; provided that such storage or transfers are in accordance with the Amended Rules adopted by the Colorado State Engineer and, with respect to transfers from District 67 accounts, shall include both the consumable and return flow portions of such water.

15. Neither the adoption of this Resolution nor the establishment or operation of the Offset Account shall constitute a waiver of either State's rights under the

Compact (if such a waiver is possible as a matter of law) or prejudice the ability of either State to represent its interests in present or future cases or controversies before the Administration or any court of competent jurisdiction, except as provided in the Stipulation.

16. All terms employed in this Resolution which are defined in the Compact or the 1980 Operating Plan shall have the same meaning as set out in the Compact or the 1980 Operating Plan, as the case may be.

17. The effective date of this Resolution shall be the date on which the Chief of Engineers of the Corps of Engineers, or his duly authorized representative, gives his approval by signing and dating below in the space provided. This Resolution shall not be affected by the termination of the 1980 Operating Plan, except that operations contemplated in this Resolution which rely on the existence of the 1980 Operating Plan shall no longer occur if the 1980 Operating Plan is terminated. This Resolution shall be in full force and effect until March 31, 1998, and year-to-year thereafter subject to the following provisions:

A. Either Colorado or Kansas, through its Compact delegation, may terminate this Resolution effective March 31 by giving written notice to the Administration by February 1 of the same Compact year.

B. In the event that this Resolution is terminated, water in the Offset Account at that time may remain in storage in the Offset Account and be released or transferred as provided above until no water remains in the Offset Account, at which time the Offset Account shall be terminated.

18. Colorado may, as it sees fit, fulfill or, as a condition to delivery of water to the Offset Account by Colorado water users, require its water users to fulfill the delivery requirements and be responsible for evaporation and transit loss charges imposed on Colorado by this Resolution, provided that Colorado shall require Colorado water users who wish to deliver water to the Offset Account to comply with this Resolution in all respects and shall require immediate cessation of the use of the Offset Account by any Colorado water user or users in the event of any substantial failure by such Colorado water user or users to comply with this Resolution.

19. Any releases of water from the Offset Account shall not exceed the channel capacity as determined by the Corps of Engineers.

JOINTLY APPROVED:

/s/ Larry E. Trujillo, Sr.
Chairman
Arkansas River Compact
Administration

/s/ Don Higbee
Recording Secretary
Arkansas River
Compact
Administration

/s/ Lloyd S. Wagner
District Engineer,
Albuquerque District,
Duly Authorized
Representative of the
Chief of Engineers
U.S. Army Corps of Engineers

17 March 1997
Date